

1989

An Experiment to Study the Effects of Changing Format and Scaling Characteristics of Financial Statement Data.

Paul Michael Goldwater

Louisiana State University and Agricultural & Mechanical College

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**An experiment to study the effects of changing format and
scaling characteristics of financial statement data**

Goldwater, Paul Michael, Ph.D.

The Louisiana State University and Agricultural and Mechanical Col., 1989

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**300 N. Zeeb Rd.
Ann Arbor, MI 48106**

**AN EXPERIMENT TO STUDY THE EFFECTS OF
CHANGING FORMAT AND SCALING CHARACTERISTICS
OF FINANCIAL STATEMENT DATA**

A DISSERTATION

**submitted to the Graduate Faculty of the
Louisiana State University
and Agricultural and Mechanical College
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy**

in

The Department of Accounting

by

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August, 1989

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I dedicate this dissertation to my father, whose personal sacrifice and discipline prepared the way for this academic marathon. He inspired me to finish the race.

The struggling for knowledge has a
pleasure in it like that of wrestling
with a fine woman.

Lord Halifax

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ABSTRACT

Current financial statements present single numbers, the result of a measurement process embracing many estimates and arbitrary classifications, summarizations, judgments, and allocations. These point-estimates and the ensuing uncertainty for decisionmakers has been cause for concern to both academics and practitioners, evoking various recommendations to change the format and scaling of financial statement data. The most significant acknowledgment of this problem came from the Financial Accounting Standards Board in 1978, when it released Objectives of Financial Reporting by Business Enterprises (SFAC No. 1). The primary interest of this research was to study the impact on decisionmaking about prospective cash flows by changing the format and scaling of financial statement data.

Subjects from six of the "Big 8" accounting firms took part in an experiment to manipulate the format (tabular versus graphical) and scaling (point-estimate versus probabilistic) of financial statement data. The subjects were required to estimate the net cash flow from operations for a hypothetical case based on the Robert Morris Associates annual statement studies for a physician's office. The subjects had numerous cues to utilize in order to make judgments about the cash flow. One hundred and seventeen subjects took part in a self-administered computerized experiment. Each subject received a diskette containing the experiment, the instructions, the case material, and the data instrument. The subjects completed the experiment in their own time and their responses were automatically recorded on the diskette.

The results of a split-plot analysis of variance disclosed that there was no significant interaction between the format, scaling and supplemental information. However, the decisionmakers were cognizant of the content of the supplemental financial data. The decisionmakers were very mindful of the distribution skewness (although not statistically significant) and adjusted their estimates of cash flow in the correct direction.

Assessing the chances of cash flows is improved if the decisionmaker is presented with both graphical and probabilistic financial data and the decisionmaker is able to assimilate the probabilistic data.

CHAPTER I

INTRODUCTION AND RATIONALE FOR THE EXPERIMENT

Introduction

Financial data¹ provided by the accounting information system results from approximate, rather than exact measurements. The totals commonly presented as final account balances in an entity's financial statements involve many estimates and arbitrary classifications, summarizations, judgments, and allocations. Despite the aura of precision that seems to surround financial statements, such measurements are generally based on rules and conventions, rather than exact amounts. The rules and conventions leads to measurement uncertainty and the implied precision leads to reporting uncertainty. The first type of uncertainty (measurement uncertainty) is a statistical property involving a probability density function. However, the probability density function is not provided in financial reports; a point-estimate is communicated. This omission of information leads to the second type of uncertainty, reporting uncertainty. Rather than having a statistical implication, reporting uncertainty is more allied to ambiguity. This ambiguity results from failing to report all the potential information. Consequently, financial statement data is both ambiguous and uncertain; nevertheless, this data often plays a major role in decisionmaking.

1. This study distinguishes between data and information. Financial information is accounting data evaluated for a specific use. A decisionmaker bases intelligent action on information, for it suggests significance and personal usefulness.

Because the data is equivocal, numerous suggestions have been made for presentation changes.² In the meantime, users continue to rely on data contained in the financial statements to make business decisions.³ Concern with the quality of financial statement data and decisions based on them has stimulated this research into improvements in the accounting process, and specifically whether the process of formatting and scaling⁴ the presentation of the financial data affects decisionmakers.

Background of the Problem

During the last twenty years, concern for the uncertainty of financial statement data and of decisions based on it has been expressed by the accounting profession itself, primarily the American Institute of Certified Public Accountants (AICPA), the academic community through the American Accounting Association (AAA), and, more recently, by the Financial Accounting Standards Board (FASB). The American Accounting Association's Committee to prepare a Statement of Basic Accounting Theory (ASOBAT) states [1966, p. 29]:

... because the accuracy of many accounting measurements depends upon future activity, there is no compelling reason why the accountant should not report in terms of interval estimates or probability distributions.

2. See for example; ASOBAT [1966], Trueblood [1973].

3. Decisionmaking under certainty assumes the availability of perfect information. Decisions are usually made, though, using partial or imperfect information. This leads to (1) decisions under risk and (2) decisions under uncertainty [Taha, 1982, pp. 417-418]. In the first case, a probability density function describes the data; in the latter situation, there is no probability density function. In other words, certainty and uncertainty represent the two extreme cases, and risk is the in-between situation.

4. Libby [1981, p. 8] defines format characteristics as numerical, graphical, or verbal, and scaling characteristics as deterministic or probabilistic.

Seven years later, the AICPA's Study Group on the Objectives of Financial Statements⁵ states [1973, p. 39]:

... measurements in terms of single numbers that do not indicate possible ranges and dispersions pose problems in describing events subject to uncertainty.

ASOBAT did not attempt to define or operationalize the terms *interval estimates* and *probability distributions*, nor did Trueblood with the terms *possible ranges* and *dispersions*. In November, 1978, (or twelve years after ASOBAT) the Financial Accounting Standards Board (FASB) issued its Statement of Financial Accounting Concepts No. 1, Objectives of Financial Reporting by Business Enterprises (SFAC No. 1) [FASB, 1978]. According to SFAC No. 1, the general objective of financial reporting is decision usefulness. Therefore, financial statements should incorporate data only if it is useful to potential users of those reports. Specifically, SFAC No. 1 states [FASB, 1978 par. 37]:

... financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise.

SFAC No. 1 was the first in a series of Statements of Financial Accounting Concepts designed to establish a base for future financial accounting and reporting standards. But SFAC No. 1 is a statement of concept alluding to, but not containing, information about the content, format, scaling, and display of financial data. These matters need to be examined and a model developed to implement the convictions of SFAC No. 1. The fundamental problem these statements address is the ambiguity of financial statements. The accounting process reduces the many transactions that comprise an account into a single number, but that single number is uncertain and the

5. This report is more commonly known as the Trueblood Report, after the name of the chairman of the committee.

presentation is ambiguous. It has an associated mean, variance and skewness, but this information is abandoned in favor of the single number. Figure 1 pictorially represents this process.

Purpose of the Study

The conceptual framework created by the FASB in their issuance of SFAC's, now supposedly complete, has been both lauded and criticized by various academicians and practitioners. For example, Gerboth states [1987, p. 2]:

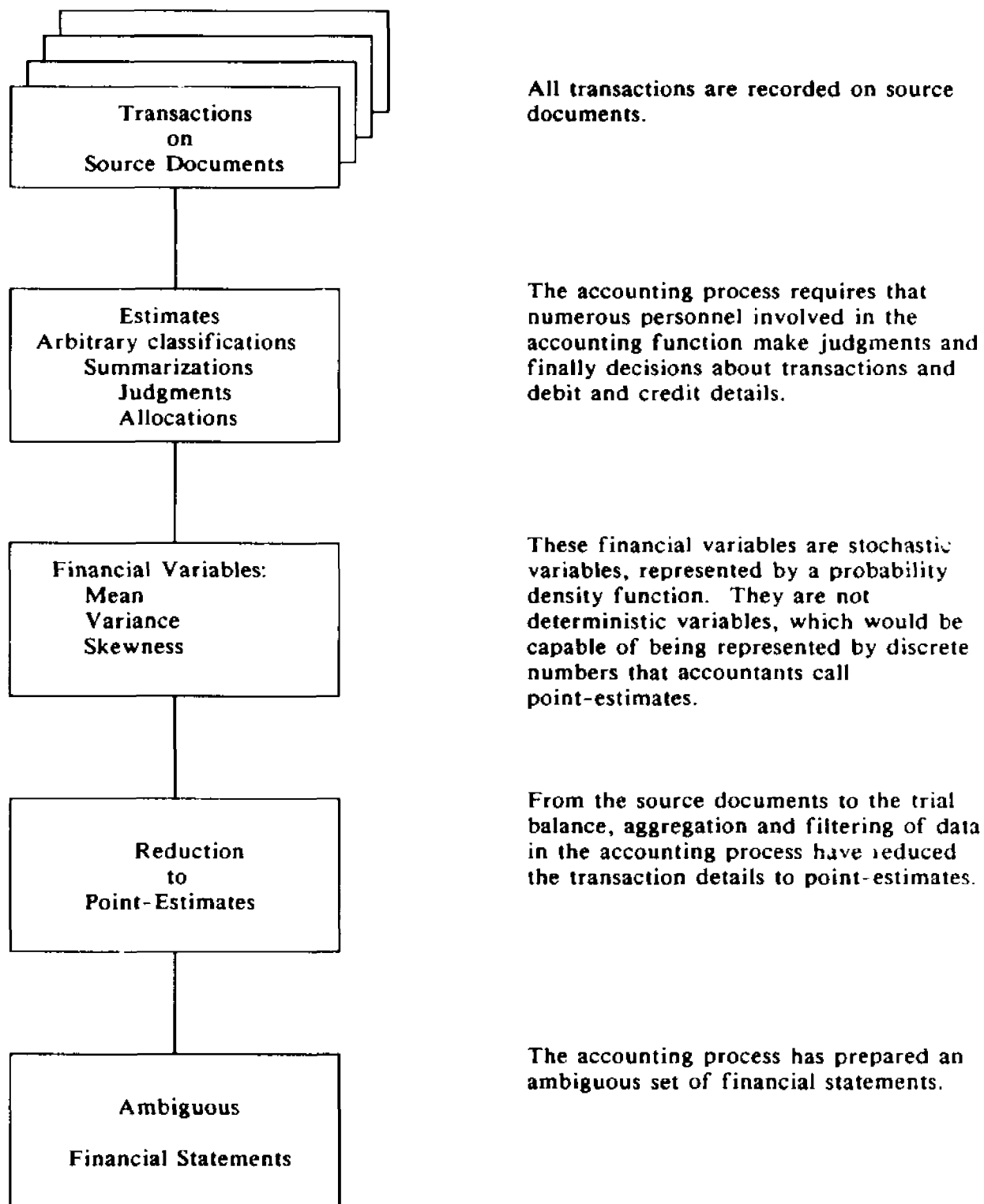
While the objectives in Statement No. 1 are widely honored, they can no more provide guidance for deciding difficult accounting issues than agreement on the sanctity of human life can provide guidance for deciding the nagging issues of abortion, euthanasia, and capital punishment.

The conceptual framework was not meant to produce instant and indisputable answers, nor was it intended to avoid, minimize, or control debate on basic issues by forcing prior agreement on abstract principles. Instead, the conceptual framework should stimulate pioneering research which will set future accounting standards. The theory of accounting should establish the practice of accounting; this theory should be founded on the scientific method of systematic, controlled, empirical, and critical investigation [Kerlinger, 1986, p. 10].

Many decisionmakers view current financial statement data as discrete, for accounting statements present single numbers, although the underlying measurement process is uncertain. Accountants tag these single numbers point-estimates. This practice effectively means that financial statements use discrete values (point-estimates)⁶ to represent stochastic variables. Furthermore, the use of discrete numbers in financial

6. The point-estimate is the single number that represents the best single-valued estimate of the quantity being measured.

FIGURE 1. From Transactions To Ambiguous Financial Statement Data



statements presented in a tabular format implies a high degree of precision. In contrast, stochastic variables are reported in a probabilistic format either graphically or tabularly. Discrete numbers, therefore, are possibly inappropriate abstractions; probabilistic financial data may be a more appropriate practice for providing decisionmakers with relevant financial data [SFAC No. 2, FASB, 1980]. This research proposes to study the implications of format and scaling characteristics of financial statement data within the framework of SFAC No. 1 and to determine whether the subject matter of SFAC No. 1 can be put into practice. This research is an effort to reduce the ambiguity associated with the numbers in financial statements, not the uncertainty. Reducing the uncertainty would effectively reduce the variance associated with a financial variable, while reducing the ambiguity illuminates the uncertainty.

Questions to be Answered

The traditional accounting process produces financial statement data shrouded in uncertainty, yet SFAC No. 1 repeatedly states that accounting must provide information to facilitate decisions about prospective net cash inflows. Historically, accounting has concerned itself with a custodial or stewardship approach to the field; only recently has it realized the importance of disseminating information to assist decisionmaking, and SFAC No. 1 formalizes this concern. Do existing financial statements provide adequate information to make such decisions? To change these financial statements would require changing either the format or scale (or both) of the numbers in the financial statements. Such a change is warranted, however, only if the benefits exceed the cost of the change, but the benefits are expected to be intangible. For example, will the decisionmakers reach greater consensus? Will they converge around a standard? Will they make more

accurate decisions in terms of their judgments about future events? These questions should be answered in the context of SFAC No. 1 and involve the task of estimating prospective net cash inflows⁷. Will the decisionmakers make more consistent decisions over a period of time? In other words, will the change be better information than is currently available. This research will be a start to investigate the broad area of formatting and scaling of financial statement data and will be limited to establishing whether or not a change in the format and scale will impact particular business decisions. Specifically, the business decision investigated is the task of estimating prospective net cash inflows. The issues of consensus, consistency, accuracy and cue utilization will be delayed for subsequent research. If changes in format and scaling have no statistical effect on decisions about prospective net cash flow, the research merit of these additional issues is inconsequential.

Delineation of the Research Problem

As previously indicated, Libby defines format characteristics as tabular, graphical, or verbal and scaling characteristics as deterministic or probabilistic. Because financial statement data is unlikely to be communicated only verbally, this level of the format variable will not be considered in this study. Accordingly, this research primarily considers the format and scaling constructs⁸ of financial statement data. Several ancillary constructs are also considered because the probabilistic framework in an experimental setting presents operational problems. These constructs include education,

7. This study emphasises a task involving cash flow because SFAC No. 1 was specific in stating the purpose of financial information is to make estimates about prospective net cash inflows.

8. The format construct will be studied for tabular and graphical capabilities, and scaling will be studied for point-estimate and probabilistic presentation of financial statement data.

financial statement percentile, and skewness. The education variable was added to ensure that the subjects were capable of correctly interpreting the probabilistic financial data. Since a review of the literature suggests that decisionmakers are not Bayesian experts,⁹ some subjects had to be familiarized or sensitized to decisionmaking under uncertainty. Financial statement percentile was added to the study as a variable because the skewness of the distribution coupled with the percentile ranking may affect the subjects' estimate of prospective net cash inflows. Poor measurement can invalidate any scientific investigation. The percentile construct should provide an objective measure of the validity and reliability of the instrument and the experimental task.

The financial statement percentile was studied at two levels, the twenty-fifth and seventy-fifth percentile, respectively, as measured by indicators in the Robert Morris Associates 1987 Annual Statement Studies (RMA). These two levels were chosen because they would have significantly different cash flows. Additionally, the expectation of cash flows would be affected by the skewness, the degree of symmetry, or the departure from symmetry of a distribution.¹⁰ The skewness of the distribution was studied for left and right skewed distributions. The degree of skewness was established based on the mean, mode and standard deviation,¹¹ such that it significantly affects the expectation of cash

9. In both regression and probabilistic judgment studies, subjects are not what Winkler [1972] has called "substantive experts": they are not familiar with the substantive area. However, in most probabilistic judgment studies, even the "substantive experts" are usually not "normative experts": they do not know how to express judgments in terms of probabilities. The ability to effectively use probabilistic data (both graphical and tabular) will vary from individual to individual.

10. Currently, accountants assume the distribution associated with a financial variable is normally distributed. Accounting textbooks assume a normal distribution for the teaching of statistical techniques, particularly in auditing procedures.

11. The mean (point-estimate) was determined from the RMA data. The mode and standard deviation were determined from 10,000 replications of a triangular distribution. The skewness was determined from the formula:

$$\text{Skewness} = (\text{Mean} - \text{Mode}) / \text{Standard Deviation}$$

flow from a financial variable in the cash flow cycle.¹²

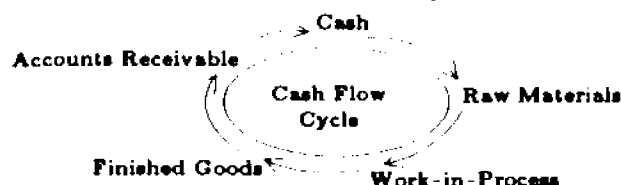
RATIONALE AND THEORETICAL FRAMEWORK

SFAC No. 1

SFAC No. 1 does not specify what information is to be supplied about prospective net cash inflows; it states only that financial information be provided so that the decisionmaker may *assess the amounts, timing, and uncertainty of prospective net cash inflows*. Nor does SFAC No. 1 indicate what format and scaling technique should be used for reporting financial data. In effect, SFAC No. 1 prescribes a model but does not describe a model. Nevertheless, although no accounting information model for uncertainty exists,¹³ decisions are made based on beliefs about the likelihood of uncertain events.

Uncertainty does not imply complete ignorance about prospective net cash inflows. The current scaling technique uses point-estimate numbers for historical reporting. These very numbers, however contribute to the uncertainty of financial

12. The conversion of cash to raw materials, work-in-process, finished goods then accounts receivable and back to accounts receivable.



13. One may consider the conservative approach of APB Statement No. 4 to be an information model for uncertainty when it states [1970, par. 36]: The complexity and uncertainty of economic activity seldom permit exact measurement. The uncertainties that surround the preparation of financial statements are reflected in a general tendency toward early recognition of unfavorable events and minimization of the amount of net assets and net income.

statement data. While prospective net cash inflows are a random variable, insufficient data about this random variable do not necessarily preclude quantifying and solving a decision model. The degree of data ignorance bears directly on how the prospective net cash inflows are modeled by decisionmakers. The options range from completely conservative (e.g., providing the traditional discrete numbers in financial statements) to completely permissive (e.g., providing the probability density function for prospective net cash inflows). Of course, one can only speculate that modeling decisions vary between the options. From a seemingly large number of available models, this research proposal investigates only a model to change the format and scaling characteristics of financial statement data.

Tversky and Kahneman

Because financial statements contain uncertainties, decisionmakers resort to heuristics. Tversky and Kahneman [1974] found that decisionmakers use heuristics in making judgments under uncertainty: (1) representativeness, usually employed to assess the probability that an object or event A belongs to a class or process B; (2) availability of instances or scenarios, often employed to assess the frequency of a class or the plausibility of a particular development; and (3) adjustment from an anchor, usually employed in numerical prediction when a relevant value is available. These heuristics are highly economical and usually effective, but they lead to systematic and predictable errors. Virtually all business decisions are made under conditions of uncertainty. Each of these decisions requires that, explicitly or implicitly, probability assessments be made. For example, plant-expansion decisions are based on probabilistic assessments of future demand, raw materials, and labor costs; commercial bank loan decisions are based on probabilistic assessment of the amount, timing and uncertainty of prospective net cash

inflows. These heuristics make complex tasks easier to master but may result in biased probability assessments. Both academics and practitioners are expressing increasing concern that these biases may adversely affect decision quality. This concern is observed, for example, in the Peat, Marwick, Main and Company's manager training program, where audit managers are routinely sensitized to these potential biases.

Libby

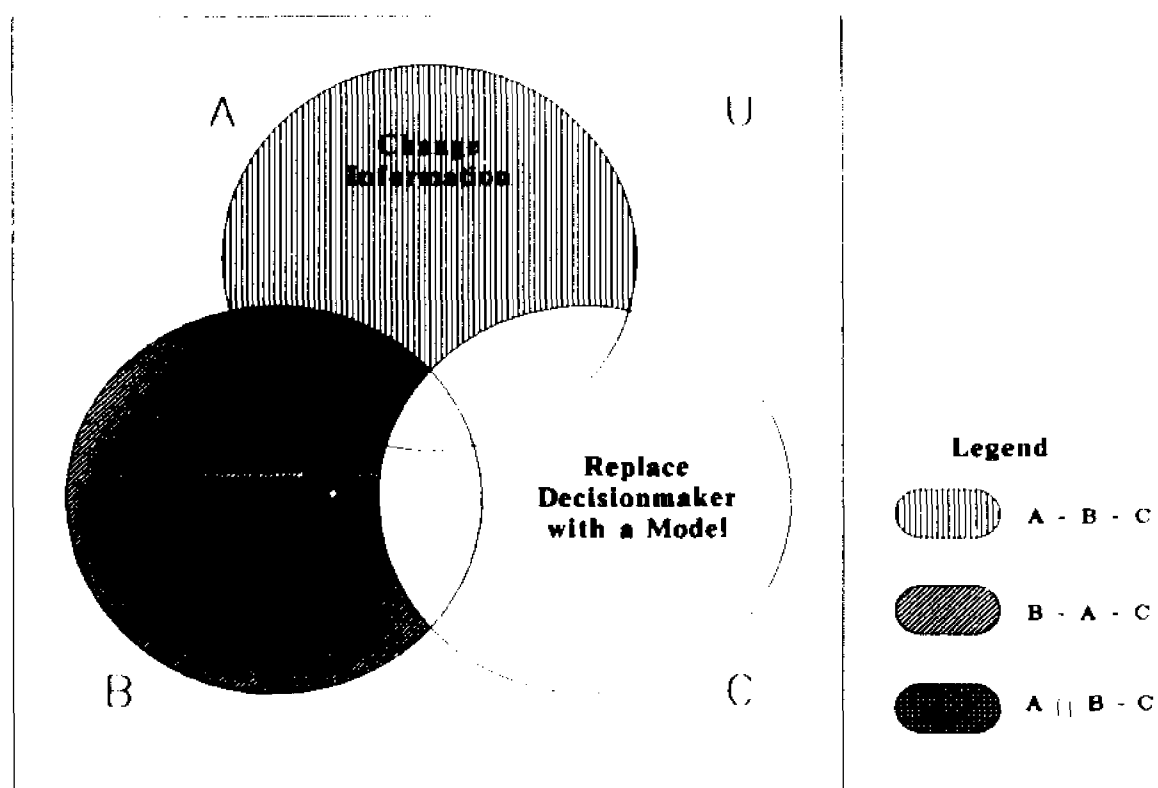
Libby [1981, p. 3] identifies three basic options to improve the quality of business decisionmaking: (1) change the information, (2) educate the decisionmaker to change the processing of information, and (3) replace the decisionmaker with a model. Figure 2 illustrates these three basic options using a Venn diagram. All members of the universe, U , are represented by the rectangle. Libby's three options are represented by the three subsets (A , B , and C) of U . Figure 2 shows the intersection of these three subsets. This research was restricted to the three shaded areas; changing the information (format and scaling characteristics of financial statement data), area "A", and educating the decisionmaker (sensitizing the decisionmaker to decisionmaking under uncertainty), area "B" and the interaction between these two areas.

Einhorn and Hogarth

To encourage progress in the area of human information processing, Einhorn and Hogarth [1981] suggest that researchers begin to incorporate information search, choice, and learning into experimental designs. Traditionally, experiments in this area have presented subjects with a predetermined set of cues to render certain judgments. Such a design, Einhorn and Hogarth observe, may reduce the involvement of subjects in the experimental task. This research adopts the opposite position: the design allowed

decisionmakers to choose from a set of information cues, the information cues which they believe are relevant to the judgmental process. This design should result in a more realistic experimental setting and, therefore contribute to the reliability and validity of the experiment.

FIGURE 2. Options For Improving Decisions



RESEARCH QUESTIONS

No empirical accounting evidence has been offered to support or refute whether decisionmaking can be affected following the concept of SFAC No. 1. The conceptual recommendation of that pronouncement must therefore be tested in practice to determine if it provides useful financial statement data to decisionmakers. SFAC No. 1, in part has been addressed in other accounting literature. A Statement of Basic Accounting Theory (ASOBAT) [1966, p. 29], Accounting Principles Board (APB) # 4, [1970], and Trueblood Report [1973, p. 39] have all recommended changes to the format and scaling of financial data to include information about the uncertainty of the data provided. This study, then, will examine the following research question:

Would reducing the ambiguity of financial statement data by changing the formatting and scaling characteristics affect business decisions about prospective net cash inflows?

In order to investigate this research question, both characteristics are independently as well as jointly evaluated. Thus the primary question can be restated as follows:

Will formatting characteristics of financial statement data affect business decisions about prospective net cash inflows?

Will scaling characteristics of financial statement data affect business decisions about prospective net cash inflows?

These conjectural statements of the relation between the two variables studied in this research will be reduced to substantive hypotheses in the next section and will be translated into operational terms in Chapter III, Methodology, p. 46.

HYPOTHESES

The substantive hypotheses [Kerlinger, 1986, p. 189] associated with the research questions are presented here, and Chapter 3 translates them into statistical terms. The first hypothesis deals with the formatting of the financial statements. In this study, the financial statement data is presented either in tabular, the traditional practice, or in graphic format. Moriarity and Roach [1979] and Moriarity [1979] suggest the use of graphics for displaying relationships between financial variables allows decisionmakers to outperform models in tasks such as analytical review and financial analysis.

H_1 The format of financial statement data affects decisions about prospective net cash inflows.

The second hypothesis deals with the scaling of financial statement data. Traditionally, financial statements have been presented with point-estimate numbers to represent the various financial variables. The measurement of these variables has been anything but exact. The measurement process -- from recording the transaction on source documents to classifying it according to the appropriate accounts and to summarizing it by ledger posting -- involves many estimates, arbitrary decisions, and allocations. Never-the-less, single numbers are reported for each account appearing in financial statements. One would argue that this approach provides an aura of precision. To appreciate the imprecision of the data, these approximations may be better presented as distributions rather than as pseudo-discrete numbers.

H_2 The scaling of financial statement data affects decisions about prospective net cash inflows.

METHODOLOGY

General

This research experiment uses a combination of a between-group design (intersubject comparison) and a within-group design (intrasubject comparison) to study five independent variables: data format, data scaling, education, financial statement percentile, and distribution skewness. These independent variables were chosen after consideration of the descriptive model developed by Libby and a previous pilot study. Figure 3 pictorially represents the relationship among these independent variables and the construction of the cases, which will be referred to by the numbers assigned to them in the figure.

The between-group design systematically manipulates three of the five factors: (1) data format, (2) data scaling, and (3) subject familiarization with decisionmaking under uncertainty. The format factor is represented at two levels by tabular and graphical financial data; the scaling factor is represented at two levels by point-estimate and probabilistic financial data; and the familiarization factor is represented at two levels with half of the probabilistic subjects receiving the education tutorial. Because it was necessary to expose only half of the subjects in the probabilistic level of the scaling factor to the tutorial, it was possible to collapse this third factor into the second factor. Consequently, instead of having a $2 \times 2 \times 2$ factorial, it was possible to have a completely crossed 2×3 factorial design. Each subject received only one level of these three factors. Figure 4 pictorially represents this between-subject design.

The within-group design systematically manipulated the remaining two of the five factors: (1) financial statement percentile and (2) distribution skewness. The two levels of financial statement percentile were represented by the Robert Morris Associates

FIGURE 3. RELATIONSHIP OF INDEPENDENT VARIABLES FORMING EXPERIMENTAL CASES

Format																			
Tabular								Graphical											
Scoring																			
Point estimate								Proportion											
Educate								Educate											
Not Applicable								Not Applicable											
Financial Statements								Financial Statements											
25%		75%		25%		75%		25%		75%		25%		75%					
Skew		Skew		Skew		Skew		Skew		Skew		Skew		Skew					
Not Applicable		Left	Right	Left	Right	Left	Right	Left	Right	Not Applicable	Left	Right	Left	Right	Left	Right			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

25th and 75th percentiles, respectively. The distribution skewness was represented at two levels by a left and a right skewed distribution. Each subject will receive both levels of these two factors. Figure 5 pictorially represents this within-subject design. Figure 4, shows that subjects in the control groups will receive two cases and subjects in the treatment groups four cases.

The most important comparisons in this experiment relate to the differential effect of changing the format and scaling characteristics of financial data. As a result, these characteristics are the between-subject factors.

Data

A physicians' clinic was chosen for the experiment because it has a relatively simple set of financial statements. The task of estimating prospective net cash inflows should be affected by the balance of accounts receivable and the likelihood of deriving cash from the receivables. Consequently, the balance of accounts receivable was isolated for manipulation in terms of the treatment factors.

Each subject received a computerized research instrument. The research instrument contained the instructions to each subject and the background information for estimating cash flows. Two basic types of data were captured during the experiment: case specific and subject specific. Subjects reviewed a case and then were asked to estimate the net cash inflows from operations for next year. With respect to the subject specific data, each person was asked a number of questions about their familiarity with the FASB conceptual framework, specifically, SFAC Nos. 1 and 2 and about their demographics and perceptions of the experiment.

The subjects were limited to partners, managers, and seniors from six of the Big Eight accounting firms. Based on the results of an initial pilot study, the time needed to

FIGURE 4. Arrangement of Cases for a 2 * 3 Intersubject Factorial Design

		Scaling and Familiarization		
		Point Estimate	Probabilistic and Education	Probabilistic
F o r m a t	Tabular	Cases 1, 2	Cases 3, 4, 5, 6	Cases 7, 8, 9, 10
	Graphical	Cases 11, 12	Cases 13, 14, 15, 16	Cases 17, 18, 19, 20

FIGURE 5. Arrangement of Cases for a 2 * 2 Intrasubject Factorial Design

		Financial Statement Percentile	
		25% percentile	75% percentile
S k e w n e s s	Left	Cases 3, 7, 13, 17	Cases 5, 9, 15, 19
	Right	Cases 4, 8, 14, 18	Cases 6, 10, 16, 20

perform the experiment was approximately one hour; therefore, instead of selecting a random sample, Big Eight senior partners were sought to solicit the cooperation of subjects to complete the experiment.

Response Improvement Techniques

Mailed questionnaire surveys frequently suffer from low response rates. Previous studies indicate that these rates may vary from 0 percent to 50 percent [Robin, 1965]. The non-response bias resulting from low rates can seriously impair the researcher's ability to draw general conclusions [Mayer-Sommer, 1979]. To minimize this weakness, the experiment will enlist the assistance of Big Eight accounting personnel to perform the experiment. Also, the correspondence with office coordinators was personalized, and the signatures of Paul M. Goldwater and Anthony P. Curatola were individually signed. As an incentive to complete and return the instrument, the subjects were offered a summary of the research results.

Instrument

The data was obtained by allowing each subject to interact with a computerized experiment. The responses of each subject was captured on a diskette and returned at the completion of the experiment; all subjects' responses were thereby consolidated into one data file for analysis.

The computerized instrument is contained on a standard (double sided, double density) diskette. The experiment executes in binary code and will run directly on any computer that supports either an MS-DOS or PC-DOS environment, version 2.0 or greater and ANSI terminal support. Because of this, most subjects were able to run the experiment. The only potential problems would occur among subjects who have access

only to a non-DOS machine or to a machine that has only a 3½-inch diskette drive. If the subject only had a non-DOS machine, then the subject would not be able to take part in the experiment, unless he or she secured the use of a DOS machine. If the subject had access only to a machine with a 3½-inch diskette drive, then the subject was able to request a 3½-inch diskette version of the experiment. Subject responses were captured by the program and stored on the diskette in a data file. Another program read the subjects' diskettes and consolidated the responses into one data base for statistical analysis. This computerized instrument facilitated recording subjects' responses to questions and the subsequent examination and analysis of data.

Statistics

The primary analysis will be based on the estimate of prospective net cash inflow from operations for next year. An ANOVA will be used to analyze subjects' data. Forming all combinations of the two intersubject factors would result in a 2×3 factorial design. Figure 4 pictorially represents the ANOVA relationship among the intersubject treatment groups. Figure 4 also represents the top three factors in Figure 3. Figure 4 and Figure 3 are interdependent. Forming all combinations of the two intrasubject factors would result in a 2×2 factorial design. Figure 5 pictorially represents the ANOVA relationship among the intrasubject treatment groups. Figure 5 represents the bottom two factors in Figure 3. Figure 5 and Figure 3 are interdependent.

The behavior predicted in hypotheses 1 and 2 can be restated in terms of the 2×3 ANOVA design (see Figure 4). This primary analysis is conducted based on the estimate of net cash inflows from operations for next year to determine if there are any significant differences between the control group and the treatment groups. The statistical relationships in the ANOVA design in Figure 5 were of secondary importance.

IMPORTANCE OF THE EXPERIMENT

SFAC No. 1 was the first in a series of Statements of Financial Accounting Concepts to establish a base of fundamentals to develop financial accounting and reporting standards. The FASB will use these objectives and concepts in developing standards of financial accounting and reporting. The FASB has not suggested that the model used in this experiment be the substance of a standard, but this model or some variation could be the substance of a FASB pronouncement.

The importance of this experiment, then, is to establish whether changing the format and scaling characteristics of financial statement data has an impact on decisionmaking. The public accounting profession leads in establishing accounting standards. Because of this and because of the intent of SFAC NO. 1, future standards must reflect the information needs of decisionmakers so that the quality of the accounting data does not impair the quality of decisionmaking. The conceptual framework will have a significant influence on the development of generally accepted accounting principles in response to the information needs of users. The need for less ambiguous accounting data is implicit; it remains to determine what data is best to provide and with what formatting and scaling characteristics it should be presented.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The literature review is divided into three major sections: (1) development of accounting as an information system, (2) discussion of historical background literature on uncertainty of financial statement data, (3) review of empirical research literature in common with this research study.

DEVELOPMENT OF ACCOUNTING AS AN INFORMATION SYSTEM

History

The following discussion of accounting will serve two purposes: it presents changes in the scope of accounting over the years that act as an impetus to this research, and it helps to define the reach of this research.

There are two main points of view about the scope of accounting. The traditional financial accounting viewpoint is described this way:

*Accounting is the art of recording, classifying, and summarizing in a significant manner and in terms of money, transactions and events which are, in part at least, of a financial character, and interpreting the results thereof.*¹⁴

14. American Institute of Certified Public Accountants (1961), p.9. This definition was originally stated in 1941.

The function of accounting is (1) to measure the resources held by specific entities; (2) to reflect the claims against and the interests in those entities; (3) to measure the changes in those resources, claims, and interests; (4) to assign the changes to specifiable periods of time; and (5) to express the forgoing in terms of money as a common denominator. [Moonitz, 1961, p. 23]

We . . . define accounting functionally, as a method of retrospective and contemporary monetary calculation the purpose of which is to provide a continuous source of financial information as a guide to future actions in the markets. [Chambers, 1966, p. 99]

All three definitions stress that accounting is carried out in monetary terms and thereby imply that non-monetary data are to be handled by someone other than an accountant. These definitions also imply that accounting focuses on the reporting of past and present events; this view is particularly stressed by Chambers [p. 98]:

To permit the inclusion of anticipated magnitudes would destroy the factual character of the results of calculation. To speak of accounting as if it included anticipatory calculations may lead to confusion among its exponents as well as its users. For it may result in the mixing of ascertained measures with hypothetical magnitudes in such a way that the mixture is deemed, mistakenly, to have the merit of objectivity.

Supporters of the financial accounting viewpoint believe that non-monetary data and data related to uncertain future events should be collected and processed, but they believe that these items are the subject of some other group (system information specialists) or, if accountants perform the task, the task itself may not be called accounting. The latter opinion is implied by Chambers when he states [pp. 97-98]:

In excluding anticipatory calculations from the domain of accounting, it is not implied that there is no similarity between the frameworks of calculation for retrospective and anticipatory calculations. There is, indeed, good reason why the general framework for both should be the same. One of the principal purposes of anticipatory calculations is to discover whether a proposed course of action may be expected to produce results and a future position which compare favorably with past results and present position. And, one of the principal purposes of retrospective calculations is to discover whether a past course of action did, in fact, produce results and a present position of the same order as was expected at the outset. These things can be discovered most conveniently if the frameworks of calculation are similar.

The management accounting viewpoint stresses that a major purpose of accounting is to supply data for decisions and that accountants need to make a stronger commitment to this purpose. This conviction is reflected in the definition of management accounting given by the American Accounting Association's Committee on Management Accounting¹⁵:

Management accounting is the application of appropriate techniques and concepts in processing the historical and projected economic data of an entity to assist management in establishing a plan for reasonable economic objectives and in making of rational decisions with a view toward achieving these objectives.

This view is supported by a later American Accounting Association committee which states¹⁶:

This report advocates a modern interpretation of accounting that responds to the broad needs for management information.

Supporters of the financial accounting viewpoint may argue that changes in format and scaling characteristics should be handled by someone other than an accountant, but often no other person does handle these data. Furthermore, the accounting system often requires only limited adjustment to incorporate many of the format and scaling calculations. With the advent of computer technology, the "system information specialist" has assumed more of the accountant's role and is now becoming the creative source of information (both routine and nonroutine) for decisionmakers. The adaptation of accounting to these needs is supported by Churchill and Stedry [1966, p. 30]:

In most business firms, accounting data are frequently the only data available whose collection proceeds periodically, without missing observations and, generally, with recurrences of the same event recorded consistently in the same category. It is this expertise that we suggest be

15. Report of Committee on Managerial Accounting (1959), p. 210.

16. Report of Committee on Managerial Decision Models (1969), p. 43.

adapted to the information requirements presented by new management techniques through expansion of the scope of the definition of accounting and its methodology. The alternative would seem to be development of an entirely new measurement theory and practice divorced from the data collection and verification traditions of accounting and the discipline of the accounting profession.

Besides the need for different format and scaling data, a need exists for better monetary data. Historically, implementation of the management accounting viewpoint has been limited. Anton points this out:

Generally, managerial accounting has taken the following forms: (1) Ad hoc approaches to single-instance decision situations simplified to involve only one or two variables, for example, make or buy decisions, (2) an expression of cost accounting technique, e.g., cost planning and control, and (3) a more or less conventional approach to budgetary planning and control [1961, p. 293].

Managerial accounting has . . . addressed itself mainly to the problems of sub-optimization, and has largely worked outside the scheme of the "continuous data-gathering" system. It is rather obvious that this has been due largely to the fact that present accounting systems do not provide an adequate structure to enable the gathering of enough pertinent managerial data from routine accounting records [1962, p. 3].

Although the management accounting viewpoint concentrates on data for management decisions, it does not ignore external reporting. Supporters of the management accounting viewpoint often believe that the data included in external reports should be based directly on the needs of the users. Supporters of the financial accounting viewpoint tend to use "generally accepted accounting principles" as the base. These principles are supposedly derived from the needs of the users, but their relationship to those needs is often unclear.

Internal and external reports have different users, but separate information systems are not necessary. In fact, their common elements need to be recognized if the information system is to be efficient. Davidson [1963, p. 117] makes this comment:

The notion of managerial analysis and financial reporting as separated, fragmented, and even opposing activities should, and I am confident will, be soon supplanted by the view which emphasizes the basic unity of the accounting function. Accounting is an information system which provides

significant, meaningful financial information about the firm - both for internal management use and for external financial reporting. What it needs is more management analysis!

Increased emphasis on management analysis is important because *"there is a widespread tendency among operating executives to think exclusively in terms of their companies' accounting systems and the reports thus generated."* [Daniel, 1961, p. 113]

Accounting is a service and should never be looked upon as an end in itself.

Furthermore, the services it provides should not be restricted by arbitrary definitions; instead, accounting should provide the services which are required and which accountants can be expected to carry out competently. The challenge before accountants is stated by Trueblood [1960, p. 50]:

Although accounting incorporates a substantial portion of the information systems within business today, it faces a substantial challenge in integrating . . . new developments with the operation of present information systems. Accountants face the challenge of who is to design and who is to operate the over-all information system of the firm . . . This all-encompassing information system would obviously not be restricted to financial data or to financial requirements. Rather all information and data required for decision-making within a firm would logically be included in a single, integrated, over-all information system for the use of management.

Recent reports of various American Accounting Association committees also reflect the view that the accounting system is part of the overall information system of the firm [AAA, 1966, p. 64]:

Essentially, accounting is an information system. More precisely, it is an application of a general theory of information to the problem of efficient economic operations. It also makes up a large part of the general information systems which provide decision-making information expressed in quantitative terms. In this context accounting is both a part of the general information system of an operating entity and a part of a basic field bounded by the concept of information.

And from the Report of the Committee on Accounting and Information Systems [1971, p. 344]:

The accounting function is one of the most important information systems in an organization. Clearly, it is not the whole of even the formal information system given (a) the diversity of data collected, processed, and distributed for the many different functions within the organization and (b) the expanded range of disciplines bearing on the information function. It is however, difficult to conceive of accounting not being an integral part of the formal information system or accounting personnel not being a major force on information management.

By far the most important statement comes from the Objectives of Financial Reporting by Business Enterprises (SFAC No. 1) [1978, par. 37]:

Financial Reporting should provide information to help present and potential investors and creditors and other users in assessing the amounts, timing, and uncertainty of prospective cash receipts from dividends or interest and the proceeds from the sale, redemption, or maturity of securities or loans. The prospects for those cash receipts are affected by an enterprise's ability to generate enough cash to meet its obligations when due and its other cash operating needs, to reinvest in operations, and to pay cash dividends and may also be affected by perceptions of investors and creditors generally about that ability, which affect market prices of the enterprise's securities. Thus, financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise.

This statement clearly emphasizes future cash flows.

Some aspects of a firm's information system, such as those based on double-entry bookkeeping, obviously belong to that firm's accounting system, but the boundary between accounting and non-accounting portions of the system is difficult to draw (unless accounting is narrowly defined.) However, trying to distinguish precisely between the two components offers no apparent advantage. A general information gathering task needs to be done, and accountants are naturally interested in that task.

Data and Information

Because this study concerns accounting information, this section draws a distinction between data and information. These terms are often confused and used interchangeably. "Data" sometimes refers to signs or signals generated as a result of direct observation of events or states. This kind of definition is used by Gregory and Van Horn [1960, p. 335]:

"Data" can be defined as any facts that are a matter of direct observation. As used in business-data processing, "data" means collections of signs or characters generally arranged in some orderly way to make up facts and figures.

"Information" is often defined as the useful knowledge obtained from the data received and, therefore, is defined for the person who receives the data and the decisions he will make. Stone [1960, p. 15] stresses the useful aspect of information:

let's distinguish carefully between "data" and "information." With some embellishment, I like Howard Levin's distinction best: Data, according to Mr. Levin, are facts or statistics, unrelated, uninterpreted, and probably I might add, unused; information, on the other hand, is knowledge derived from the organization and analysis of data. Information, in other words, is data that are useful in achieving the objectives of the business.¹⁷

Bedford and Onsi [1966, p. 16] stress the personal nature of this usefulness:

Information . . . represents accounting data evaluated for a specific use. To an accountant, information is the fundamental material upon which intelligent action is based. It has the connotation of significant data

The distinction between information and data is that information is concerned with the use of evaluated data for a specified problem and for a certain individual at a certain time to achieve a definite goal.

Unfortunately these definitions of data and information exclude certain signs and signals even though they are pertinent to the discussion. If data include only facts based on direct observation, then they do not include the results of mathematical decision

17. His reference is to: Howard S. Levin, *Office Work and Automation*, New York: John Wiley and Sons, 1966, p. 122.

models and the signs and characters which represent an individual's beliefs, e.g., a distribution of the balance of accounts receivable from a simulation of individual accounts. However, these signs are often recorded and transmitted to decisionmakers by information system specialists and industrial engineers, and it therefore seems reasonable to refer to them as data. This point of view is supported by Anton [1962, pp. 3-4]:

Data has first the narrow meaning: any facts that are a matter of direct observation A broader meaning for data, however, is necessary in order to force "data" from the historical character given it by the narrow meaning. That is, we must be able to use data say in a data-processing system that are not facts subject to direct observation. We must be able to use "data" to postulate, hypothesize, and then predict, as in simulations. We can then broadly redefine data in terms of sensory perceptive phenomena, i.e., the signs and characters, themselves, and not necessarily the facts represented.

In this study, "data" refer to signs and characters generated by a person or a machine, provided these signs and characters have a meaning which is understood by the person who determined how they would be generated.

The above definition of "information" excludes signs and characters which add to the decisionmaker's knowledge if this knowledge is not used in making any decisions. Therefore, the decision process must be specified before any particular sign or character can be designated as information; these decisions, moreover may be far in the future. In this study, information refers to the meaning derived from data provided the knowledge of the person receiving those data is changed. Hence, whether certain data provide information depends on the state of the receiver at the time the data is received.

Interestingly, this definition of information allows "misinformation" to be treated as information. The definition says nothing about accuracy or reliability. The term "useful information" is no longer redundant, for information does not imply usefulness.

"Useful" is merely one of a number of characteristics which may be attributed to various kinds of information. Cherry [1957, pp. 226-227] points out several of these characteristics:

The word "information" is used, in everyday speech, in different ways. We speak of useful information, of valuable information, of factual information, of reliable information, of precise information, of true information Clearly, the adjectives useful, useless, valuable, and the like, applied to "information," suggest some definite user (useful or valuable to whom?) whereas factual or precise do not Whether the information is useful, or valuable, depends upon a person's needs or circumstances. Whether it is reliable depends upon personal experience of that particular source of information.

"Regardless of the manner in which information is viewed, its function is to reduce the amount or range of uncertainty under which decisions are made" [Bedford and Onsi, 1966, p. 16]. The firm's expected payoff is usually increased if the uncertainty about future events is decreased. Future events cannot be directly observed, but probability distributions over these events depend upon the decisionmakers knowledge about the past. Therefore, reductions in the uncertainty with respect to past events usually reduces the uncertainty with respect to future events.

HISTORICAL BACKGROUND LITERATURE AS INCENTIVE FOR STUDY

The accounting process has evolved from a custodial (or stewardship) function to an information function. This is expressed by the change from traditional postulates, principles, and concepts of accounting to the conceptual framework agenda. However, this change in emphasis from a *custodial function* to a *useful information objective* has not been absolutely accepted. Concern for the presentation of financial statement data has existed for many years. In the accounting profession, this concern has been

expressed by the profession itself, primarily the American Institute of Certified Public Accountants (AICPA), the academic community through the American Accounting Association (AAA), and the Financial Accounting Standards Board (FASB).

American Accounting Association

The first of these statements by the American Accounting Association was very specific about reporting. The Association published A Statement of Basic Accounting Theory (ASOBAT) in which it recommends [1966, p. 29]:

Because the accuracy of many accounting measurements depends upon future activity, there is no compelling reason why the accountant should not report in terms of interval estimates or probability distributions.

ASOBAT did not seek to implement its statement by recommending whether or not the interval estimates or probability distributions should be represented in terms of tabular numbers about mean, variance, skewness, and kurtosis, or in graphical representation.

Accounting Principles Board

The now defunct Accounting Principles Board (APB) voiced a more conservative approach in 1970. In Basic Concepts and Accounting Principles Underlying Financial Statements of Business Enterprises (APB Statement No. 4) it states [1970, par. 35]:

The complexity and uncertainty of economic activity seldom permit exact measurement. The uncertainties that surround the preparation of financial statements are reflected in a general tendency toward early recognition of unfavorable events and minimization of the amount of net assets and net income.

The APB dealt with the matter of uncertainty by recommending that financial reporting adopt a conservative approach and, rather than improve the information by changing the format and scaling of financial statement data presentation, the information should be

presented with the error on the side of conservatism. Some might view this as specifically misrepresenting the financial statement data. This statement describes existing (and sometime conflicting) concepts more than it prescribes preferable concepts.

American Institute of Certified Public Accountants

Three years later, the American Institute of Certified Public Accountants' report, Objectives of Financial Statements (Trueblood Committee Report), states [1973, p. 39]:

Measurements in terms of single numbers that do not indicate possible ranges and dispersions pose problems in describing events subject to uncertainty.

The Trueblood statement has a semantic difference from the ASOBAT statement in so far as Trueblood recommends *ranges and dispersions* whereas ASOBAT recommends *interval estimates or probability distributions*. Neither statement makes clear what is specifically meant by words like ranges, dispersions, interval estimates and probability distributions. Previously Trueblood [1960, p. 50] pointed out:

there are today no generally accepted criteria for the design of an integrated information system for a firm - - for deciding what information is needed, how frequently the information is required, how accurate it needs to be, and how the information is to be originated and transmitted. There is today no structural method of viewing many of the financial, and nonfinancial, decisions of the firm.

Accounting and the decisionmaking arena both recognize that the person evaluating the information alternatives may not be the user of that information.

Financial Accounting Standards Board

Finally, The Financial Accounting Standards Board issued Objectives of Financial Reporting by Business Enterprises (SFAC No. 1) in which it states [1978, par. 37]:

financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise.

Summary

All of these statements make different recommendations for the uncertainty of financial statement data. Table 1. summarizes the position taken by each of these statements.

SFAC No. 1 is the most important of these statements because it is the first of the conceptual framework statements which are intended to be a coherent system of interrelated objectives and concepts leading to consistent standards by imposing a philosophical discipline on the standard setters. The conceptual framework project dates from April 1973 when a topic described as "broad qualitative standards for financial reporting" was placed on the FASB's original technical agenda. FASB completed the first major phase of the framework late in 1978 with the publication of Financial Accounting Concepts No. 1, Objectives of Financial Reporting by Business Enterprises. Nothing in this statement can be readily implemented. Specifically, there are no suggestions or recommendations about how to report or present financial information about the *amount, timing, and uncertainty of prospective net cash inflows.*

TABLE 1. Summary Of Accounting Statements On Uncertainty

<u>Source</u>	<u>Statement</u>	<u>Year</u>	<u>Recommendation</u>
AAA	ASOBAT	1966	interval estimates or probability distributions
AICPA	APB # 4	1970	adopt conservatism
AICPA	Trueblood	1973	ranges and dispersions
FASB	SFAC # 1	1978	nothing specifically stated

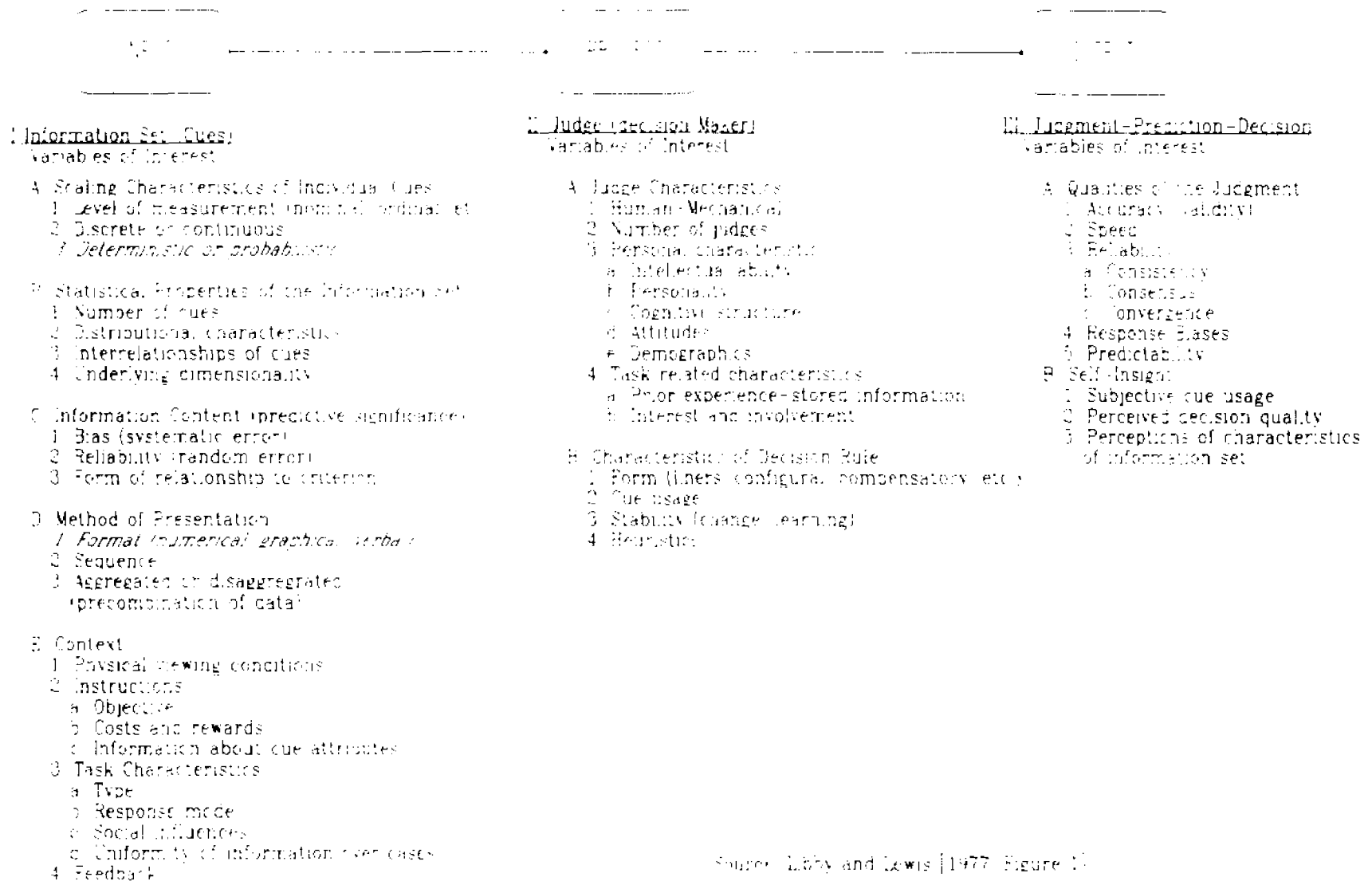
Knowledge of the Board's objectives and concepts should enable all who are affected by or interested in financial accounting standards to better understand the content and limitations of information provided by financial accounting and reporting; such knowledge will further ability to use that information effectively while enhancing confidence in financial reporting. The information often results from approximate rather than exact measures and largely reflects the financial effects of transactions and events that have already happened. The objectives are directed toward the many users' common interest in the ability of an enterprise to generate favorable cash flows, but these objectives are phrased using investment and credit decisions as a reference to give them a focus. The objectives are intended to be broad rather than narrow and pertain to financial reporting; they are not restricted to financial statements.

EMPIRICAL ACCOUNTING RESEARCH IN COMMON WITH THIS STUDY

Introduction

Libby and Lewis [1977] established a framework for classifying underlying information processing variables. The system classifies variables of interest for three separate components of an information's processing model: input, process, and output. Although this listing is not exhaustive, it provides a basis for linking applied issues to more basic components. This researcher has used this classification system to organize the empirical research literature in common with this study. The Libby and Lewis classification of information processing variables appears in Figure 6; the variables of specific interest in this study are in italics. This structure is very general and can be applied to almost any decisionmaking scheme. Again, consider a simplified commercial

FIGURE 6 Classification of Information-Processing Variables



Source: Libby and Lewis [1977, Figure 1].

lending decision in which the principal task of the loan officer is to predict loan default. Loan default-nondefault is mainly a function of the future cash flows available to the customer to service the debt. The customer provides a number of cues, some of which are probabilistically related to future cash flows. These include indicators of liquidity, leverage, and profitability drawn from financial statements; management evaluations resulting from interviews, plant visits, and discussions with other knowledgeable parties; and outside credit ratings. No individual cue or combination of cues is a perfect predictor of future cash flows, and there is overlap in the information (e.g., credit ratings are closely associated with profitability and liquidity measures). In making this judgment, the loan officer combines these cues into a prediction of future cash flows. Even if the banker's judgment policy is highly stable over time, some inconsistencies are likely to arise, resulting in a probabilistic relationship between the cues and the final judgment. At the end of the term of each loan, the officer's prediction of cash flows can be compared with the actual event, and any resulting losses can be computed to measure achievement. While this example is highly simplified, it illustrates the generality of the framework and its importance for accountants. The model's principal concern with information processing achievement in an uncertain world coincides both with accountants' interest in improving the decisions made by users of accounting information and with their more recent attention to the quality of their own decisions.

Scaling (Point-estimate or Probabilistic)

The idea of using normative decision theory in auditing [Kinney, 1975], management control [Dyckman, 1969], and information system selection [Demske, 1972] has prompted a considerable volume of accounting research into human processing of probabilistic information. Most models suggested for the accountant's use involve

choosing an action to maximize the decision maker's effectiveness when the payoff or consequence to the decision maker depends on his action and the occurrence of some state of nature. Conceptually, such models require the decision maker to (1) specify all possible states of nature and feasible alternative actions, (2) define the payoffs or consequences and assign utility measure to them, (3) evaluate information and form a subjective probability distribution over the possible states and (4) choose the optimal action. The decisionmaker is assumed to be an expected utility maximizer and a Bayesian processor of information. Although these models are conceptualized as sequential, in practice we may be able to observe only the final action. To avoid the apparent confounding problems, most research in this area has attempted to study separately the specific components of the models. Probability estimation has received by far the most attention.

Format (Tabular or Graphical)

Even though management accountants and information systems designers are responsible for determining much of the content and format of management reports, accountants have little researched the relationships of these variables to learning and achievement. The next two studies are particularly interesting because they address the relationship of data presentation to prediction accuracy and cue usage. Questions about data presentation, though a natural concern for management accountants and information systems designers, have received little attention from researchers.

Multidimensional graphics have been suggested as an aid to the human's ability to follow trends in related variables such as financial statement data. The particular method investigated was Chernoff's [1973] schematic faces. In two experiments Moriarity [1979] evaluated the use of multidimensional graphics in place of standard

financial statement presentations. In the first, 277 introductory accounting students predicted the failure of 22 discounted retail firms (half of which had failed) on the basis of 1 of 4 presentations of 6 years' data: (1) schematic faces with no explanation, (2) schematic faces with an explanation of what the features represented, (3) selected financial statement balances needed to calculate the Dun and Bradstreet key ratios, and (4) the key ratios themselves. The schematic faces were based on simple transformation (i.e., one financial variable controls the length of the nose, another the width, etc.). Financial variables were assigned to features on the basis of the author's judgment of their importance. Average errors out of 22 were 7.3, 7.09, 7.49, and 8.62, respectively. The only significant difference was that the "key ratio" group was less accurate than the other three. However, response times for the schematic faces groups were significantly lower. A second experiment compared the judgments of 20 practicing accountants based on the ratios and faces presentations. Each participant evaluated half of the firms on the basis of each presentation. The order was reversed for half of the subjects. The subjects judged an average of 6.5 cases incorrectly using the ratios, and only 4.7 using the faces.

Another study compared monetary vs non-monetary cue presentation. Harrell and Klick [1980] determined whether cue usage is affected by monetary vs non-monetary cue presentation. In a personnel evaluation task, 166 senior Air Force colonels evaluated 36 hypothetical captains ($2^2 * 3^2$ factorial) for promotion based on five cues, three of which were varied. One cue, the training cost of replacing the officer, was also presented in three alternate forms: dollars, months, and dollars and months. The derived weights placed on the cost cue for the "dollars" and "months" cases were compared. Only the weight placed on the replacement cost cue was significantly different, indicating that a greater emphasis was placed on the cue when it was

measured in dollars. This result suggests either that the costs of training pilots for a certain time period were greater than the subjects expected or that the presentation metric caused the effect.

Uncertainty of Financial Statement Data

Individual choice is often characterized by considerable inconsistency. Many studies point to this conclusion; these studies have been surveyed and summarized by several well-known mathematical psychologists and economists [McFadden, 1975, 1986, 1977; Schoemaker, 1982; Einhorn and Hogarth 1981; Luce and Suppes, 1965]. The following quotations from Tversky typify this fairly broad-based observation of inconsistent choice behavior:

Individuals, however, are not perfectly consistent in their choices. When faced with repeated choices between X and Y, people often choose X in some instances and Y in others. Furthermore, such inconsistencies are observed even in the absence of systematic changes in the decisionmaker's tastes which might be due to learning or sequential effects. It seems, therefore, that the observed inconsistencies reflect inherent variability or momentary fluctuation in the evaluative process. This consideration suggests that preference should be defined in a probabilistic fashion [Tversky, 1972a].

Joyce [1976] points out that auditors have become increasingly concerned that different staff members make widely differing decisions in the same circumstances. A number of studies in internal control and materiality deal with consensus. Ashton [1974] assesses decision consensus, cue usage, decision rule form, and self-insight of auditor's internal control evaluations. In the experiments, the participants evaluated internal control cases, indicating whether different internal control features existed. The cases were formed and analyzed using ANOVA. Ashton found that the auditors' evaluations exhibited a high degree of between-judge consensus and consistency over time in their evaluations. Auditors relied most heavily on the separation of duties in forming their

judgments and were quite aware of their judgmental process. Hamilton and Wright [1977] made minor modifications in Ashton's experiment to investigate the impact of experience levels. The results substantially mirrored Ashton's. Additionally, they discovered that more experienced auditors exhibited greater consensus. Two others, Ashton and Kramer [1980] and Ashton and Brown [1980] replicated Ashton's original work. Ashton and Kramer [1980] compared the judgments of students and auditors in the same task. The students were less predictable, placed less emphasis on separation of duties, and had less self-insight than the auditors. Ashton and Brown [1980] modified Ashton's instrument to add two additional cues, making the task more complex and thus more realistic. Again, the results were almost identical to Ashton [1974]. Separation of duties was by far the most important factor, but the new rotation of duties cue was given little weight. Ashton and Brown concluded that the added complexity of the task had no effect.

Libby [1979a] compared commercial lenders' perceptions of messages intended to be communicated by different audit reports. Allegations of different perceptions had formed the rationale for suggested changes in the audit reporting framework. Each subject evaluated the similarity of the messages intended by all pairs of 10 different audit reports (unqualified and different types of uncertainty, and scope qualifications and disclaimers) and rated the reports on 13 adjective rating scales. Contrary to the beliefs of a number of policy makers, all measures indicated highly similar perceptions between the auditors and bankers. The two observed dimensions were tentatively identified by the researcher as "need for additional information" and amount of "audit judgment" required. Libby [1979b] tested the effect of uncertainty disclosure and the incremental effect of the auditor's qualification on lending decisions. Thirty-four commercial loan officers from four banks participated in the study. Using extensive

background data and case specific information, they evaluated a \$2 million term loan request from a medium-sized family-owned paperboard fabricating company. While ANOVA was used as the method of case construction, a number of modifications were made to achieve a more representative design. First, four basic cases were formed by combining two levels of complete financial statements and verbal management evaluations. These four cases were then combined with uncertainty disclosures-supplemental data combinations. Because consultation with the participating banks suggested that the litigation disclosure was always followed by a supplemental in-house investigation, these two variables were purposely combined into one three-level cue: (1) no disclosure, (2) disclosure combined with a supplemental report predicting a positive outcome, and (3) disclosure with supplemental report predicting a negative outcome. The subjects were then split into two groups depending on the type of audit report issued when an uncertainty was disclosed (unqualified or "subject to" qualification). Unlike in prior studies, this factor was made between-subjects factor to mask the principal purpose of the study - - the test of the audit report variable. Both the financial statement and management evaluation manipulations were significant. While the uncertainty disclosure-supplemental report variable had a large significant effect on the subjects' judgments, the type of audit report seemed to have no effect. These initial conclusions were conditioned on the assumption that the loan officers would not change their information search behavior because of the form of the audit report.

The primary output of any accounting system is information. As a result, the study of information has assumed a prominent role in accounting research. Almost any issue in the study of accounting can be reduced to a question about the choice or use of information; this research study is no exception. Choice is a complex behavioral process

involving subjective evaluation and judgment. Many factors complicate the choice process. For example, decisionmakers are subject to changing tastes as learning and growth take place. Most importantly, human beings are subject to cognitive limitations or, in Simon's terminology, bounded rationality [Simon, 1978, 1979]. The result is that human choice behavior is characterized by certain heuristics and biases (e.g., Tversky and Kahneman [1974]), seemingly irrational decisions (e.g., Thaler [1980]), and inconsistencies. The propensity of human decisionmakers to make intransitive and inconsistent choices has been noted by economists and psychologists alike. Tversky [1972a], for example, observes that

when faced with a choice among several alternatives, people often experience uncertainty and exhibit inconsistency. That is, people are often not sure which alternative they should select, nor do they always make the same choice under seemingly identical conditions. In order to account for the observed inconsistency and the reported uncertainty, choice behavior has been viewed as a probabilistic process.

Similar observations have been made by Debreu [1958, 1960a, 1960b], Backer, Degroot and Marschak [1963], Luce and Suppes [1965], and McFadden [1975, 1977].

The complexity of choices and the cognitive limitations of decisionmakers faced with such choices appear not only in everyday personal decisions, but also in businesses and governmental units of all types. Moreover, the characteristics of choice situations and choice behavior may be expected to affect both the type of information which should be provided to decisionmakers and the way in which that information will be used once it is received. As providers of information, accountants must be concerned about characteristics of decisionmaker behavior and the implications of this behavior for information choice and use. To the extent that human choice behavior reflects the kinds of heuristics and inconsistencies mentioned above, accountants should be cognizant of the possible implications of such behavior for information use.

Many business decisions are based on beliefs concerning the likelihood of uncertain events. Decisionmakers typically rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental exercises. Tversky and Kahneman [1974] described three heuristics that are employed in making judgments under uncertainty: (1) representativeness, which is usually employed when people are asked to judge the probability that an object or event A belongs to class or process B; (2) availability of instances or scenarios, which is often employed when people are asked to assess the frequency of a class or the plausibility of a particular development; and (3) adjustment from an anchor, which is usually employed in numerical prediction when a relevant value is available. These heuristics are highly economical and usually effective, but they lead to systematic and predictable errors. A better understanding of these heuristics and of the biases to which they lead could improve judgments and decisions in situations of uncertainty.

Judging the amounts, timing, and uncertainty of prospective net cash inflows requires an estimate of the probability distribution of the future cash flows. Operations and collateral provide the sources of future cash flows. Financial statement information plays a major role in determining the evaluation phase of the sources of cash from operations and collateral. In general, the financial statements indicate the nature of assets available to serve as collateral and the sources and amounts of prior years' cash flows from operations. Additionally, in using the information in the financial statements, the decisionmaker must evaluate the accuracy of the statements and estimate the outcome of any uncertainties in the statements.

Decisionmakers attempt to insure the accuracy of the financial statement data by requiring that the statements be subjected to an audit by independent certified public accountants. The auditors' way of communicating his findings to the decisionmaker is the audit report, which indicates both the scope of the auditor's examination and the conclusions he has drawn concerning the "fairness" of the financial presentations. The communication process between the auditor and the decisionmaker focuses on reporting deficiencies which result in departures from the auditor's standard report.

Uncertainties such as the balance of accounts receivable and the amount and timing of conversion into cash have a major impact on estimates of a prospect's future cash flows. In judging the importance and effect of an uncertainty in the financial statements, the decisionmaker usually consults with management. The auditor does not deal specifically with this kind of uncertainty, and he is typically conservative when determining the balance of accounts receivable.

Decisionmakers' judgments of inherent uncertainties in the data of financial statements are of some importance. Does information about these uncertainties affect such judgments? The lack of information about uncertainties can lead to two types of errors. The first, called a type I or alpha error, occurs when the decisionmaker has a negative impression of future cash flows but the cash flows are ultimately favorable. The second, the type II or beta error, happens when the decisionmaker makes a positive decision about future cash flows but the cash flows are ultimately unfavorable. The auditor, incidentally is not required to provide this information about the inherent uncertainty of financial statement data; nevertheless, the uncertainty should affect the decisionmaker's estimate of future cash flows.

Libby [1979] found that uncertainty qualifications indicate (1) an increase in loan risk and (2) the need for additional information with which to estimate the effects of the uncertainty. These messages form the basis of the research questions and the hypotheses examined in this study.

CHAPTER III

METHODOLOGY

This chapter discusses the methodology used to investigate, analyze and explain the possible cause and effect relationship between the quality of business decisionmaking and the manipulation of the format and scaling characteristics of financial statement data in the context of the need for financial information to assess the amounts, timing, and uncertainty of prospective net cash inflows. The chapter describes the research methodology, the research design, the implications of a pilot study, the selection of subjects, the experimental instrument, and the field procedures followed. Additionally, it details the collection, recording, processing and analysis of data; the methodological assumptions and limitations of the experiment; a statement of hypotheses in operational form; and a summary. This experiment attempted to raise new questions and new possibilities, and it examines an old problem from a new perspective.

Overview

The existing literature suggests that little has been accomplished either theoretically or empirically to develop an accounting information model to lessen the inherent ambiguity in existing financial statement data. Consequently, the primary research question addressed in this study asks:

Would reducing the ambiguity of financial statement data by changing the formatting and scaling characteristics affect business decisions about prospective net cash inflows?

This major research question must be divided into its natural components in order to investigate and answer the questions about the main effects and effects of interaction among the factors noted in the study. Therefore, the following subsidiary questions need to be examined:

- (1) Will formatting characteristics of financial statement data affect business decisions about prospective net cash inflows?
- (2) Will scaling characteristics of financial statement data affect business decisions about prospective net cash inflows?

The Research Design section (see p. 48) first explains the rationale for the choice of factors and their operational definitions, then their transformation into statistical hypotheses in the alternate form.

DESCRIPTION OF RESEARCH METHODOLOGY

This study is an experimental research investigation to determine whether a cause-and-effect relationship exists between format and scaling characteristics of financial statement data and decisions about prospective net cash inflows. To respond to the proposed research questions, the research methodology will test for treatment differences with a split-plot factorial ANOVA design [Huck, Cormier, & Bounds, 1974, pp. 106-130; Neter, Wasserman, & Kutner, 1985, pp. 1021-1026].

A split-plot factorial combines a between-group design (intersubject comparison) and a within-group design (intrasubject comparison). It resembles a standard ANOVA in terms of (1) the number of *F* ratios that appear in the summary table, (2) the procedure for graphing the interaction, and (3) the procedures for follow-up analyses for both multiple comparisons and simple main effects [Huck, Cormier, & Bounds, 1974, pp. 106-130]. The experiment rigorously managed the experimental variables and conditions

by directly controlling and manipulating the experimental variables and randomizing the subjects to experimental groups. The design used two control groups as a baseline against which to compare the experimental groups receiving the experimental treatments. Experimental procedures randomly assigned subjects to the experimental treatment groups in order to secure maximum variance of the research variables of primary interest, minimum extraneous variance, and minimum error or random variance, including the errors of measurement.

RESEARCH DESIGN

In this experiment, as previously indicated, the research design uses a combination of a between-group design (intersubject comparison) and a within-group design (intrasubject comparison). Chapter I introduces and briefly discusses five independent variables to be manipulated in this study. An in-depth discussion of these variables is provided at this time.

Independent Variables

The five variables in this experiment were chosen after consideration of the recommendations of ASOBAT [1966], Trueblood [1973], SFAC No. 1 [1973], the work of Tversky and Kahneman, and two previous pilot studies. The independent variables are intended to be relevant to the research question, with realistic levels to be studied. Moreover, they are arranged in combination to account for any interaction of meaningful relationships. Variables of primary interest are arranged as intersubject variables, and variables of secondary interest are arranged as intrasubject variables. The five independent variables are information format, information scaling, subject

education, financial statement percentile, and distribution skewness. The first three variables -- information format, information scaling, and subject education -- are the between-group (intersubject) variables. The financial statement percentile and distribution skewness are the within-group (intrasubject) variables. Figure 7 presents the sequence and combination of these variables pictorially. Each independent variable has two levels. To provide practical significance, these variables were framed in the context of a physicians' clinic set of financial statement data. After examining the data from the Robert Morris Associates annual statement studies (RMA), a physicians' clinic context was chosen because it had the simplest set of financial statements among those published by RMA. This was an important consideration, in view of the subjects' task to estimate cash flow from operations. The only balance sheet variable to influence or affect the subjects' estimate was accounts receivable, and consequently, this facilitated operationalizing the experiment.

The first factor to be discussed is financial statement format. Of the two levels of this independent variable -- tabular and graphical presentation of financial statement data -- the tabular level represents the current format of financial statement data presentation. This level will be operationalized by presenting GAAP (generally accepted accounting principles) financial statements. The second level represents an alternative format for presenting financial statement data. Moriarity and Roach [1979] and Moriarity [1979] suggest the use of graphics for displaying relationships between financial variables to allow decisionmakers to outperform models in tasks such as analytical review and financial analysis. This level will be operationalized by constructing a graphical presentation of the accounts receivable balance.

FIGURE 7. RELATIONSHIP OF INDEPENDENT VARIABLES FORMING EXPERIMENTAL CASES

Format																			
Tabular									Graphical										
Scaling																			
Non-est. scale									Est. scale										
Probabilistic									Probabilistic										
Educate									Educate										
Not Applicable									Not Applicable										
Financial Statements									Financial Statements										
25%		75%		25%		75%		25%		75%		25%		75%		25%		75%	
Skew		Skew		Skew		Skew		Skew		Skew		Skew		Skew		Skew		Skew	
Not Applicable		Left	Right	Left	Right	Left	Right	Left	Right	Not Applicable		Left	Right	Left	Right	Left	Right	Left	Right
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

The second factor, scaling, represents financial statement data either with traditional point-estimates or probabilistic information. The American Accounting Association's Committee to prepare a Statement of Basic Accounting Theory (ASOBAT) states [1966, p. 29]:

... because the accuracy of many accounting measurements depends upon future activity, there is no compelling reason why the accountant should not report in terms of interval estimates or probability distributions.

In mathematics an interval estimate judges or determines generally but carefully the set containing all numbers between two given numbers and includes one, both, or neither end point. Probability distributions indicate the number of times a set of numbers will on average occur over the range of possible occurrences. *Interval estimates* and *probability distributions* differ in that the latter indicates something about the behavior of the numbers between the end points. The AICPA's Study Group on the Objectives of Financial Statements states [1973, p. 39]:

... measurements in terms of single numbers that do not indicate possible ranges and dispersions pose problems in describing events subject to uncertainty.

This report is less informative and less mathematically specific about how to clarify the ambiguity in financial statement data. Contrast *range* with *interval estimate*; a range is the difference between the largest and smallest values in a sample whereas the *interval estimate* is the set of all numbers in the range. A *dispersion* is the variation or scattering of data around a median value, which is less informative than a *probability distribution*.

Current financial statements present data with point-estimates which indicate nothing of the behavior of the numbers and the possible limits of their behavior around the point-estimates. Therefore, the first level of this factor will be the point-estimate scaling of financial statement data with which we are currently accustomed. The

measurement of these variables -- from recording transactions on source documents to classifying them in the appropriate accounts to then summarizing them by ledger posting -- involves many estimates, arbitrary decisions and allocations. Despite the aura of precision that may seem to surround point-estimate numbers in financial statements, the measurements are generally approximations rather than exact amounts. These approximations may be better presented in terms of probabilistic data than pseudo-discrete numbers.¹⁸ The data can be discrete only if the outcome of each variable is known exactly, but this seldom occurs with data in financial statements. For example, the balance of accounts receivable is a collection of random variables $\{X_t, t \in T\}$ all defined on a common sample (probability) space. For our purposes, t has the connotation of an account receivable, and T , called the index set, determines the number of random variables (accounts receivable) in the collection. The set of all possible values that X_t can take on for any value of t is called the state space of the stochastic process [Law & Kelton, 1982, p. 142]. Therefore, the second level of this variable will be represented by probabilistic data. The probabilistic level of this variable will be crossed with the format factor to be operationalized either graphically by a probability density function or tabularly by the mean, range and standard deviation of the distribution.

For the third factor, half of the subjects receiving probabilistic data were sensitized to probability theory and decision making under risk. A review of the literature and an initial pilot study suggested that the subjects would have limited ability to analyze probabilistic financial information regardless of whether it were tabular or graphical. Also, a probabilistic framework in an experimental setting presents operational problems. In both regression and probabilistic judgment studies, subjects

18. Pseudo-discrete numbers are used in financial statements to represent purportedly deterministic variables.

often are not what Winkler [1972] has called "substantive experts"; they are not familiar with the substantive area. However, in most probabilistic judgment studies, even the "substantive experts" are usually not "normative experts"; they do not know how to express judgments in terms of probabilities. The ability to use probabilistic data (both graphical and tabular) effectively will vary from individual to individual. One possible explanation for the poor results obtained in studies of probabilistic data thus far might be that users are unfamiliar with probabilistic data and therefore have difficulty interpreting data, remembering information, and making decisions based on this kind of information. Additionally, there may be a strong "conditioning bond" felt by decisionmakers for tabular format data they have used in the past (traditional financial statements). This is supported by the studies on "functional fixation" [Einhorn and Hogarth, 1981]. Research suggests that decisionmakers employ several simple decision heuristics which allow them to solve complex problems using their limited cognitive abilities [Libby, 1981 p. 52]. These decision rules can lead to significant biases; therefore, the subjects would either ignore the cue or fail to understand the distribution of accounts receivable and adopt some heuristic to make their decision. This factor was operationalized by subjecting half of the subjects to a computerized tutorial on basic concepts of probability theory and decision making under risk. It should be noted that the tutorial is not expected to remove the "conditioning bond." Rather it is expected to provide some minimal understanding.

The fourth factor required two different sets of complete two-year comparative financial statements combined with five-year financial summaries to be prepared. These financial statements were approximate physicians' ranking in the twenty-fifth and seventy-fifth percentile, respectively, as measured by financial ratios in the Robert

Morris Associates 1986 Annual Statement Studies. The two levels were chosen so that (1) the poorer of the two would have marginal cash flows from operations and (2) the better firm would have strong cash flows from operations.

Finally, the fifth factor required two different distributions of accounts receivable. One distribution was skewed left, while the other was skewed right. The modal value of each distribution was located to have a material effect on the cash flow to be derived from the balance of accounts receivable. The left skewed distribution clearly indicated that a majority of the balance of accounts receivable would be converted into cash; the right skewed distribution clearly indicated a minority of the balance of accounts receivable would be converted into cash.

Each of the three intersubject factors (format, scaling, and education) has two levels. Forming all combinations of the three intersubject factors would result in a $2 * 2 * 2$ factorial design. But the plausibility of the cases (see Figure 7, p. 50) is a matter of some importance, and therefore some cases are sufficiently implausible as to cast doubt on their contribution to the study. Education on the scaling characteristics of financial data will not be provided to the subjects allocated to the point-estimate level of the format factor. The combination of tabular format, point-estimate scaling and scaling education has little if any inherent validity.¹⁹ Therefore, the intersubject design can be reduced to a $2 * 3$ factorial ANOVA design and is represented pictorially in Figure 7, page 50. This reduced both the number of treatment cases and subjects needed for the experiment.

¹⁹ The subjects would typically not have the opportunity, not to mention the need, to utilize the scaling education in relationship to the other two factors (point-estimate and tabular).

Figure 7 illustrates the construction of the cases from the independent variables. Each case is referred to by the number assigned in the circle. The most important comparisons in this study relate to the differential effect of adding graphical and probabilistic financial data to the financial statements. In this design, these factors were treated as between-subjects factors. The financial statement percentiles and distribution skewness were treated as within-subject factors. Consequently, the cases were split into six groups. Group 1 was the primary control group (cases 1, 2). Group 2 contains the tabular, probabilistic information with sensitization to decision theory (cases 3, 4, 5, 6). Group 3 will contain the probabilistic tabular data, (cases 7, 8, 9, 10). Group 4 will be a second control group, containing the graphical, point-estimate data with no sensitization to decision theory (cases 11, 12). Group 5 will contain the graphical, probabilistic information with sensitization (cases 13, 14, 15, 16). Group 6 will contain the probabilistic graphical data (cases 17, 18, 19, 20). Group 1 (tabular and point-estimate) represent the current practice of presenting financial statement data mandated by Rule 203. Group 4 (graphical and point-estimate) is a secondary control group for many decisionmakers do receive numerous pie charts and histograms in addition to Group 1 data, and modern computer hardware and software afford the decisionmaker with opportunities to use graphics.

Dependent Variables

The dependent (response) variables have sufficient criterion reliability to minimize the probability that measurement error, per se, will mask a significant difference present in the outcomes. Previous research on the responses of decisionmakers to financial statements has incorporated a wide variety of experimental tasks and response variables. Most of these studies have involved bank loan officers.

Several studies have asked lenders to state the maximum amount that they would be willing to lend to hypothetical loan applicants [Oliver, 1972; Abdel-khalik, 1973; Estes and Reimer, 1977; Keys, 1978; Firth, 1979]. Other studies have involved the prediction of bankruptcy [Kennedy, 1975; Libby, 1975; Casey, 1980; Zimmer, 1980] or the prediction of loan default [Abdel-khalik and El-Sheshai, 1980; and Zimmer, 1981]. Wilkins and Zimmer [1983] asked loan officers to assess the ability of loan applicants to repay two separate four-year term loan amounts and to state the maximum amount they would lend to each applicant. Libby [1979] and Johnson and Pany [1984] asked lenders to make an accept/reject recommendation for a specified loan amount. Then, participants accepting the loan proposal would provide the interest rate premium that they would charge the applicant. Participants rejecting the loan estimated the premium that they believed alternate financial institutions willing to accept the loan proposal would charge. These researchers chose the "ability to repay" variable after reviewing the professional banking literature which suggests that the primary purpose of financial analysis by loan officers is to assess the ability of the applicant to repay. This present research required each subject to respond to the following question:

What is your best estimate of the operating net cash inflow for next year?

This question directly answers the subject matter of SFAC No. 1. Appendix B (see p. 143), presents a copy of the screen the subjects see when answering this question.

In the debriefing questionnaire, the subjects also answered a series of questions about their perceptions of the experiment and their demographic characteristics. Each question required either a dichotomous Yes-No response or a personal quantitative estimate. Appendix B (see p. 144), presents these questions in detail.

All subjects finally stated whether they would like to receive a summary of the experimental results; if so, they were to respond with their name and address. Appendix B (see p. 143), presents these questions in detail as well as the format of the subjects' answer necessary to receive a copy of the research results.

All of these subject responses were automatically recorded on the diskette. In addition to the subject responses to direct questions, the system also automatically recorded the time it took each subject to act on information cues, make a decision for the case, and the total elapsed time to complete the experiment.

Research Hypotheses

Libby [1979] tested a set of hypotheses concerning the effect of uncertainty disclosure and the incremental effect of the auditor's qualification on lending decisions. The uncertainty increased perceived loan risk and motivated the search for additional information about the uncertainty. Libby's research and the theoretical framework of SFAC No. 1 form the basis of the hypotheses examined in this experiment.

The first set of hypotheses concerns the effect on perceived cash flow from operations when changes are made in the formatting and scaling characteristics of financial statement data. Uncertain financial statement data would decrease the mean and increase the variance of expected cash flows;²⁰ this produces two effects which are described in Libby [1979]. The first is increased perceived uncertainty for expected cash flows, which should cause the decisionmakers to revise downward their evaluation of the prospective net cash inflow. The second effect is the motivation to use additional

20. In Bayesian terminology, redundant information produces a likelihood ratio conditioned on the hypotheses and other data, of one, resulting in no change in the posterior probability estimate. It is possible that the format and scaling characteristics have information content when conditioned on the hypotheses alone but have none when also conditioned on the other sources of data.

information to estimate the outcome of the uncertainty. Statistical decision theory indicates that an increase in the population variance increases the value of additional sample information. This type of response to increased uncertainty has also been found in behavioral studies in other contexts [Lee, 1987, chap. 8]. Since disclosure of the uncertainty increases the variance of expected cash flows, decisionmakers would probably rely on additional information. If they do, estimates of prospective net cash inflows should be higher when such information predicts a positive rather than negative outcome of the uncertainty. This suggests the first set of hypotheses:

- H₁ When a material uncertainty is indicated, the estimate of prospective net cash inflows increases when probabilistic and graphical data about the uncertainty is disclosed, and will be higher when the supplemental data concerning the uncertainty is positive.²¹
- H₂ When supplemental data about a material uncertainty is disclosed, the estimate of prospective net cash inflows will be higher for graphical information than for tabular information, and will be higher when the supplemental data concerning the uncertainty is positive.
- H₃ When supplemental data about a material uncertainty is disclosed, the estimate of prospective net cash inflows will be higher for probabilistic information than for point-estimate information, and will be higher when the supplemental data concerning the uncertainty is positive.

The second set of hypotheses concerns the effect on perceived cash flow from operations when the decisionmaker is presented with financial statement data from the 25th and 75th percentiles of the Robert Morris Associates annual surveys and the probabilistic financial statement data is skewed both left and right. The 25th and 75th

21. The 75th percentile financial statements are by definition more positive than the 25th percentile financial statements. Similarly, the left skewed distribution is statistically more positive than the right skewed distribution.

percentiles are far enough apart and reflect data sufficiently different that the decisionmakers' estimate of cash flow from operations should be affected. This suggests the second set of hypotheses.

- H_4 The estimate of prospective net cash inflows will be higher for the 75th percentile financial statements and left skewed distribution than for the 25th percentile financial statements and right skewed distribution.
- H_5 The estimate of prospective net cash inflows will be higher for the 75th percentile financial statements than for the 25th percentile financial statements.
- H_6 The estimate of prospective net cash inflows will be higher for left skewed distribution financial statement data than for right skewed financial statement data.

PILOT STUDIES

Two pilot studies were completed. The first involved the basic research question and was tested through a procedure involving a limited number of case studies with only the format and scaling factors presented to subjects on a paper instrument. The pilot study results suggested that the subjects had limited ability to analyze information about uncertainty; it also confirmed the representativeness of both the financial statements and accounts receivable distributions. Based on the results, a computerized instrument was designed and programmed to present the case material, control the experiment, and capture the subjects' responses. After extensive consultation, it was believed that the computerized instrument would add to the validity and reliability of the data obtained from the subjects. This pilot study used graduate students and accounting faculty at Louisiana State University.

The pilot studies led to changing some hypotheses, dropping some, and developing new hypotheses. The second pilot study provided new ideas, approaches, and clues not foreseen in the first pilot study and led to changes being made to the computer program that controls the subjects during the experiment. Both pilot studies permitted a preliminary testing of the hypotheses that led to testing more precise hypotheses in this main study.

SELECTION OF SUBJECTS

The stated hypotheses indicate that the appropriate individuals from whom to elicit responses for this research study are major users of financial statements. The results of sample surveys are always subject to some uncertainty because only part of the population has been measured and because of errors of measurement. To reduce this uncertainty, this study uses as large a sample as possible²² and employs a computerized instrument of measurement. This section of the study presents and justifies the selected focal population and also addresses the sampling procedures necessary to enhance the validity and reliability of the data obtained.

Focal Population

The intention is to obtain a large sample because the smaller the sampling errors, the greater the reliability and the increased power of the statistical tests applied to the data [Cochran, 1977]. Despite the advantages of using large representative samples, several logistical problems prevent this objective. There are many users and preparers of

22. A total of 276 diskettes were duplicated and prepared for distribution to the subjects.

financial statements, but the context of the experimental task involves SFAC No. 1 and estimating net cash inflows from operations. Since certified public accountants should be familiar with SFAC No. 1 as a pronouncement of the Financial Accounting Standards Board, they were selected as the population from which subjects are drawn.

This experiment is based on SFAC No. 1, the first statement published by the FASB under the conceptual framework project. The conceptual framework establishes the objectives of financial reporting, the definitions of elements that should be reported on financial statements, the attributes of those elements that should be measured, the methods of measuring those attributes, the qualitative characteristics those measurements must possess, and the location of that information in financial reports. To quote the FASB [1980, p. i]:

The conceptual framework is a coherent system of interrelated objectives and fundamentals that is expected to lead to consistent standards and that prescribes the nature, function, and limits of financial accounting and reporting. It is expected to serve the public interest by providing structure and direction to financial accounting and reporting to facilitate the provision of evenhanded financial and related information that is useful in assisting capital and other markets to function efficiently in allocating scarce resources in the economy.

SFAC does not constitute a document enforceable under Rule 203 of the Rules of Conduct of the AICPA and, according to the FASB, "does not establish GAAP." Furthermore, conflicts between Rule 203 documents and SFAC's should be resolved in favor of Rule 203 documents. An SFAC serves as an articulation of fundamental accounting thought, providing a basis for assuring that detailed operational accounting standards and practices are consistent with the overall purposes of financial reporting. Therefore, CPA's are a logical group of subjects to use in this experiment.

Certified Public Accountants

Accountants are generally acknowledged as the primary preparers of financial information [APB, 1969; Hofstedt and Hughes, 1977]. Certified Public Accountants (CPA's), a category of "accountant," both prepare and formulate judgments and advise their clients concerning the implications of the numbers contained in financial statements. Independent CPA's are required by their profession to comply with the pronouncements of the FASB. The SFAC framework is not subject to Rule 203, but accountants are intimately involved with establishing future accounting standards; consequently, they need to be familiar with the conceptual framework. A restriction on this sampling frame limits the experiment to "Big 8" seniors, managers, and partners as identified in six of the "Big 8" offices located in New Orleans, Dallas, and Houston. This sampling frame was adopted to obtain reliable and valid data, and the cooperation of a senior firm member from each office would be needed to control the distribution and return of the diskettes. Logistically, this was the most effective and efficient method to obtain reliable and valid research data.

This study assumes that the sampling frame is complete; that is, all members of the population are included in the frame. However, chance frequently determines whether the units of actual interest in the study are actually contacted. Thus, the estimated figure may vary as a result of sampling rather than of contacting all elements in the sampling frames. These, however, are general limitations of any such procedure [Cochran, 1977].

Sampling theory also assumes that the observations obtained from each respondent are the correct ones for that respondent [Cochran, 1977]. Since this study will use a self-administered instrument, the assumption will be made that participants

answer honestly and to the best of their ability. The data will be analyzed for outliers and extreme outliers to determine if any data elements should be dropped from the analysis.

INSTRUMENTATION

Data was gathered via a computerized research instrument designed and programmed by the researcher specifically for this study. The research instrument consisted of two parts:

- (1) a transmittal letter,
- (2) a computer diskette (either 3½ or 5¼ inch) containing:
 - (1) the assumptions and instructions applicable to the study,
 - (2) the cases to be analyzed, and
 - (3) a set of debriefing questions.

General Overview of Instrument

The data was obtained by administering the experiment to a group of CPA's at the level of senior, manager, and partner. The data was captured on a diskette and returned at the completion of the experiment, whereby all subjects' responses were automatically consolidated into one data file for analysis.

The computerized instrument was contained on a standard (double sided, double density) diskette. The experiment was on the diskette in binary code using standard ANSI drivers and ran directly on any computer that supported either an MS-DOS or PC-DOS environment, version 2.0 or greater and ANSI terminal support. Because of this, all subjects were able to run the experiment. Any subject who had access only to a 3½-inch diskette drive machine was given a 3½-inch diskette version of the experiment. All subjects had access to either MS-DOS or PC-DOS machines. The program

controlling the experiment executed in less than 256KB of RAM memory. Subject responses were captured by the program and stored. Another program read the subjects' diskettes and consolidated the responses into one data base for statistical analysis. A computerized instrument facilitated the recording of subject responses to questions and maintained control over the subject and experimental conditions. Therefore, it should have resulted in more accurate measurement of response data as well as in greater reliability and validity of the experiment. The instrument automatically allocated the subject to one of the six treatment groups (see Figure 9, p. 72). This was accomplished by the computer program's generating a pseudo-random number from a uniform distribution; based on the number generated, the subject was allocated to one of the treatment groups that determined which cases were presented to the subjects.

Task

Depending on the group to which the subject was allocated, the subject was asked to analyze either two or four hypothetical cases (see Figure 7, p. 50 and Figure 8, p. 72). The subjects were told that the case financial data represents an average physician's clinic practice. The subjects' group determined the number of available cues. Table 2 presents the relationship between the cues and the six groups. All groups received cues 1 to 8 inclusive, but cues 9, 10 and 11 were for the variables being manipulated and were available only to subjects in the appropriate treatment groups. The symbol X indicates that the cue was available to subjects in that group. For example, the cue "Distribution of Accounts Receivable" was available only to subjects in groups 4, 5, and 6. Examples of the cues are presented in Appendix B (see p. 143).

TABLE 2. Relationship Between Cues and Experimental Groups

<u>Cue</u>	<u>Group</u>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
1. Statement of Earnings (Income Statement)	x	x	x	x	x	x
2. Statement of Financial Position (Balance Sheet)	x	x	x	x	x	x
3. Statement of Cash Flows	x	x	x	x	x	x
4. Notes to Financial Statements	x	x	x	x	x	x
5. Five Year Summary	x	x	x	x	x	x
6. Audit Report	x	x	x	x	x	x
7. Credit Report	x	x	x	x	x	x
8. Robert Morris Associates ratios	x	x	x	x	x	x
9. Redo Tutorial on Uncertainty		x			x	
10. Summary Statistics on Accounts Receivable	x	x	x			
11. Distribution of Accounts Receivable				x	x	x

Statement of Earnings (Income Statement)

This cue was prepared for both the 25th and the 75th percentile based on the Robert Morris Associates 1987 annual statement studies.

Statement of Financial Position (Balance Sheet)

This cue was prepared for both the 25th and the 75th percentile based on the Robert Morris Associates 1987 annual statement studies.

Statement of Cash Flows

The Robert Morris Associates 1987 annual statement studies did not present the numbers specifically for cash flow; therefore, these numbers were derived from the available data for both the 25th and the 75th percentile.

Notes to Financial Statements

These were formulated based on the data in the balance sheet and required FASB disclosures.

Five Year Summary

This cue was prepared for both the 25th and the 75th percentile based on the Robert Morris Associates 1987 annual statement studies.

Audit Report

The audit report was written based on SAS No. 58 and Libby's [1979] work which found that when uncertainty is specifically disclosed, the decisionmaker will seek other information to clarify the uncertainty. The audit report was written with an explanatory paragraph describing the uncertainty surrounding the collectability of accounts receivable. The paragraph indicated that the accounts receivable balance cannot presently be determined.

Credit Report

The credit report was prepared after consultation with local senior bank personnel.

Robert Morris Associates Ratios

These ratios were taken directly from the 1987 annual data published by Robert Morris Associates.

Redo Tutorial on Uncertainty

The subjects who received the tutorial initially as part of the treatment group also had the opportunity to redo the tutorial at any time.

Summary Statistics on Accounts Receivable and Distribution of Accounts Receivable

The probability density function was generated using a model developed by Law and Kelton [1982, p. 167] when there is little data available. A triangular distribution was replicated 10,000 times to generate the data for the scaling of the accounts receivable balance. The parameters of the triangular distribution, a , b , and c are real numbers with $a < c < b$; where a is a location parameter, $b - a$ is a scale parameter, and

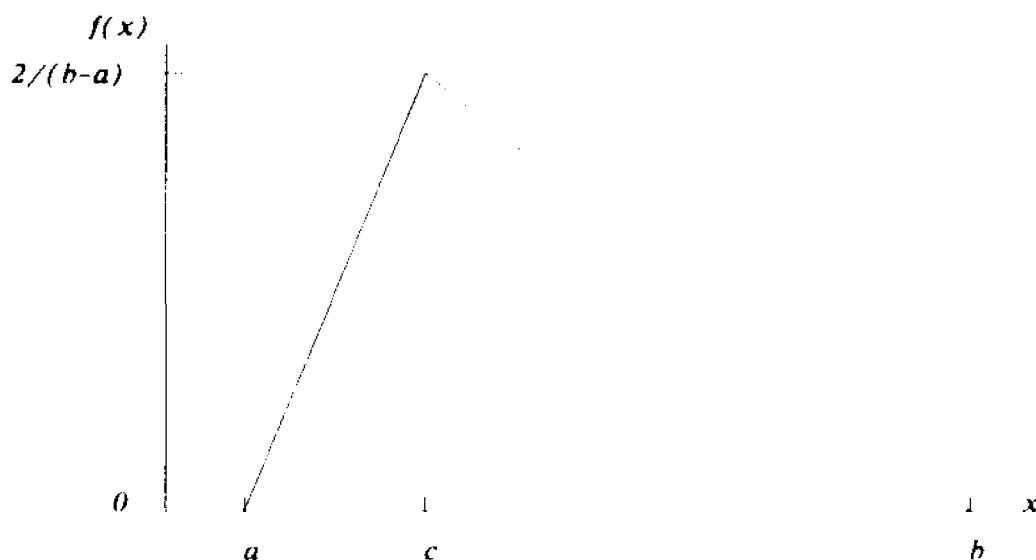
c is a shape parameter. The range of the distribution is $[a, b]$. Table 3 gives relevant information to simulate modeling applications for a triangular distribution. The density function and distribution function (in simple closed form) are indicated. There is a short description of the parameters; the range indicates the interval in which the associated random variables can take on values. Also listed are the mean (expectation), variance, and mode, i.e., the value at which the density function is maximized.

TABLE 3. Triangular Distribution

Density (refer Figure 8)	$f(x) = \frac{2(x-a)}{(b-a)(c-a)}$	if $a \leq x \leq c$
	$\frac{2(b-x)}{(b-a)(b-c)}$	if $c < x \leq b$
	0	otherwise
Distribution	$F(x) = 0$	$x < a$
	$\frac{(x-a)^2}{(b-a)(c-a)}$	if $a \leq x \leq c$
	$1 - \frac{(b-x)^2}{(b-a)(b-c)}$	if $c < x \leq b$
	1	if $b < x$
Parameters	a, b , and c real numbers with $a < c < b$. a is a location parameter, $b-a$ is a scale parameter, c is a shape parameter	
Range	$[a, b]$	
Mean	$(a+b+c)/3$	
Variance	$a^2+b^2+c^2-ab-ac-bc/18$	
Mode	c	

The cues in each case present representative financial information. Overall, the structure of each case follows the same basic pattern. The subject's task in each case involves four major components:

- (1) Select the necessary cues to make judgments about estimates of net cash inflow from operations;
- (2) Make the decision about the estimate of net cash inflow;
- (3) Answer the debriefing questionnaire;
- (4) Provide subject name and address, if a summary of the results is to be sent after the experiment is completed.

FIGURE 8. Triangular Density Function


This computerized approach did not overburden the subjects with calculations and unnecessary paper to manipulate. Also, the task is one with which the subjects are highly familiar. Much of each subject's job is to make judgments about relevant financial information -- to read, evaluate, and then act on the information message contained in those financial statements. For CPA's this involves the advising and counseling of clients concerning financial matters, specifically the estimating of prospective net cash inflows from operations.

Non-Response Bias

Low response rates occur frequently in mailed questionnaire studies, and, as a result, the possibility of non-response bias emerges. Non-response results from a variety of factors: the study issue, the questionnaire format, a lack of subject interest in the

topic, or the subject's demographic characteristics, to name a few [Alreck and Settle, 1985]. Existence of non-respondents may bias the results of any study and limit the conclusions. Accordingly, techniques to minimize this bias were undertaken. In addition, the computerized instrument in this study adds a novelty to the experiment which should help minimize the non-response bias.

The subjects received the experimental materials at various times over a four month period. The initial contact with five of the "Big 8" offices took place during the first and second weeks of December, 1988. One of these five was not contacted until the first week of January, 1989. The experimental materials were delivered to some of the subjects starting in mid-December, and the final materials were delivered to subjects the following March. Consequently, there was a four-month lag between the first subjects' receiving the experimental materials and the last subjects' receiving the experimental materials. This lag was unavoidable because the subjects were involved in the peak of the audit season.

Field Procedures

Each subject received a research instrument consisting of (1) a transmittal letter (see Appendix A, p. 128), and (2) a diskette containing the experiment in the form of a software program.²³

²³. Both the instructions and the diskette software were extensively pilot tested to insure the clarity of instructions, ease of use of the software, and the reasonableness of the task. Refer to the section on Pilot Studies, p. 59, for a detailed discussion.

The computer program randomly allocated each subject to one of the treatment groups (Figure 9, p. 72). Based on the treatment group, the subjects were then presented with the cases. The order of the cases within a group was randomized. Likewise, the order of the cues for each case was randomized when the program placed the cues on the screen.

The transmittal letter, which provided a statement of the purpose and value of the research, endeavored to involve the subject in a constructive and appealing way, yet it established a reasonable but firm return date. An offer was also made to send the subject a copy of the summary findings. This transmittal letter was sent on the researcher's personal letterhead and was signed by both the researcher and the committee chairman. Refer to Appendix A (see p. 128) for an example of the transmittal letter.

The instructions were typed directly on a label, one copy of which was attached to the top of the diskette and another to the diskette jacket. The instructions were minimal:

1. Start your computer with DOS.
2. Insert diskette in drive A.
3. Type GO and press return.

These were the only instructions required to start the experiment. The experiment presented four instructions on the screen to all subjects, reminding them what was required of them during the experiment. For a complete sequence of screen flips refer to Appendix B (see p. 131). To complete the experiment, the subjects needed access to an MS-DOS or PC-DOS microcomputer with at least 320KB of RAM.²⁴ The memory limitation was never a problem, for the machines available in "Big 8" offices invariably have 640KB of RAM. The experiment was self-explanatory once it started.

²⁴ RAM means random access memory.

The subjects could respond to most system prompts with a single keystroke and then press the RETURN (or ENTER) key. The subjects were required to use the keyboard more extensively only when they were offered a summary copy of the analysis and findings of the experiment; then the subjects typed their name and address. After completing the experiment, they returned the diskette to the office contact person in charge of the experiment.

DATA PROCESSING AND ANALYSIS

Both skewness and percentile are called within-subject factors because all combinations occur within each of the subjects. The format and scaling are between-subject factors. The between-subject factors subdivide the sample into six discrete subgroups. Each subject has only one value for a subgroup and, thus, for a between-subject factor.

This split-plot design will compare group means by applying the inferential statistics ANOVA to the data (estimate of prospective net cash inflow) of the dependent variable [Neter, Wasserman and Kutner, 1985 p.661]. The behavior predicted in Hypotheses 1, 2, and 3 can be restated in terms of the intersubject 2×3 ANOVA design represented in Figure 9. The behavior predicted in Hypotheses 4, 5, and 6 can be restated in terms of the intrasubject 2×2 ANOVA design represented in Figure 10.

The database of subjects' responses was analyzed using the SPSS/PC+ statistical software package. This product is the personal computer version of the SPSS mainframe product. SPSS automatically read the consolidated main data base of subjects' responses, thus avoiding the re-entry of subjects' responses into the SPSS database.

FIGURE 9. Arrangement of Cases for a 2 * 3 Intersubject Factorial Design

		Scaling and Familiarization		
		Point-estimate	Probabilistic and Familiarize	Probabilistic
F o r m a t	Tabular	Cases 1, 2 Group 1	Cases 3, 4, 5, 6 Group 2	Cases 7, 8, 9, 10 Group 3
	Graphical	Cases 11, 12 Group 4	Cases 13, 14, 15, 16 Group 5	Cases 17, 18, 19, 20 Group 6

FIGURE 10. Arrangement of Cases for a 2 * 2 Intrasubject Factorial Design

		Financial Statement Percentile	
		25% percentile	75% percentile
S k e w n e s s	Left	Cases 1, 3, 7, 11, 13, 17	Cases 2, 5, 9, 12, 15, 19
	Right	Cases 1, 4, 8, 11, 14, 18	Cases 2, 6, 10, 12, 16, 20

Parametric Test

The primary analysis was conducted based on the "cash flow from operations" responses. The data was examined for normality of the responses and symmetry of the variance-covariance matrix. The model is usually considered robust to violations of the first two assumptions, particularly when there are equal group sizes [Neter et al, p. 615].

For the univariate model to be valid in a within-subject design, the variance-covariance matrix of the transformed variables used to test each effect must have covariance of 0 as well as equal variance. Including between-subject factors in a design necessitates an additional assumption: the variance-covariance matrices for the transformed variables for a particular effect must be equal for all levels of the between-subjects factors. If these two assumptions, often called the "symmetry conditions," are not tenable, the *F* ratios from the averaged univariate results may not be correct.

LIMITATIONS

As in any research effort, one must consider some of the limitations of this study. First, a random selection process for determining subjects was not followed, for the basic list of CPAs was limited to six of the "Big 8" accounting firms in the New Orleans, Dallas, and Houston areas. Generalizing beyond this group may be hazardous.

A study which asks the respondents to reply to more than one level of a variable runs the risk of producing significant differences because the subjects can determine the variable levels being tested. In this study an attempt was made to control this possibility by having a response variable in which there are no right or wrong answers and by having the software prevent the respondent from returning to a case and either

reviewing or changing the answers. Also, the task was difficult and challenging enough to thwart any effort to guess the experiment's objective. However, the possibility still existed that the use of the repeated measures might produce any significant differences. While the design allows each subject to serve as his own control, it may foster differences in responses that result purely from the respondent's reading all the scenarios and replying in a manner which he believes the experimenter desires. Finally, with respect to the respondents, one should note that CPA's constitute only one group of users of financial information. For policy-making decisions, all groups of users need to be considered. However, the importance of this CPA group cannot be denied.

The results of the study will depend for their validity on the data's compliance with the various assumptions of the ANOVA technique. Two of these assumptions deserve special note. First, the observations were assumed to be from a normal distribution. However, the effects of non-normality on the nominal level of significance of the *F*-test are extremely slight. Additionally, homogeneity of variance between cells is assumed in split-plot ANOVA applications. Cochran's [Kirk, 1968, pp. 62-66] procedure was used to test whether significant violations existed.

Only a limited number of variables could be analyzed, and only a few levels of each variable could be tested. Other variables may also be important, and other levels of the variables may be important. Therefore, the results can be generalized only to this particular set of cues and to those particular variable levels from which the results were generated.

Certain limitations are inherent in the methodology which will be used in this research. First, the questionnaire approach traditionally has resulted in a relatively low response rate; consequently, some degree of nonresponse bias may be present. Because this experiment used a computerized questionnaire, a higher-than-usual response rate

resulted. A certain amount of control over the quality of subject responses is sacrificed because the experimental task was not personally administered by the researcher. A self-administered experimental task makes one assume that the appropriate respondents performed the task to the best of their ability. To the extent that this assumption is not valid, the research results will be biased. Once again, the computerized questionnaire possibly elicited a greater awareness of concern for the task by the subjects.

Another limitation from using a questionnaire format relates to the artificial simplification of an ordinarily complex task. The amount of information provided to respondents must be restricted in order to keep the research instrument and the experimental task to a reasonable length. The discussions with CPA's and the pilot study were used to ensure that all necessary information was included.

Subjects to take part in the experiment needed to have access to a microcomputer. This limitation may have led to some (probably very limited) self-selection of subjects.

SUMMARY

This chapter discusses the methodological procedures followed in a study to ascertain whether changing the format and scaling characteristics of financial statement data affects the quality of decisionmaking. The six hypotheses to be investigated focus on the formatting and scaling of financial information.

A group of decisionmakers, the focal population of this study, was identified: certified public accountants. The sampling procedure adopted a systematic random sample with random allocation of subjects to the treatment groups, and twenty cases were developed to investigate the research hypotheses. These cases represent the

factorial combinations of the independent variables. The subjects' task was to estimate the net cash inflow from operations for a hypothetical physicians' office using financial data taken from the 1987 Robert Morris Associates annual statement studies. The instrument was computerized to increase the reliability and validity of the experiment and of the measurement process. This chapter has expanded the discussion from Chapter I concerning the methodology of this study.

CHAPTER IV

DATA ANALYSIS AND EMPIRICAL RESULTS

Introduction

This experiment examined whether the information objective stated in SFAC No. 1 can be operationalized by modifying the format and scaling characteristics of existing financial statement data. This chapter presents the results of examining²⁵ and analyzing²⁶ the experimental data obtained from the subjects. This chapter includes (1) a discussion of the overall and group response rates, (2) a discussion of the reliability of subjects' data, (3) a detailed examination of the subjects' data, (4) a presentation of the statistical analysis of the hypotheses, and (5) an examination of the debriefing characteristics and comments of subjects.

RESPONSE

The subjects of interest in this study are the senior personnel of "Big 8" accounting firms. Specifically, seniors, managers, and partners from six firms in the New Orleans, Dallas, and Houston areas were used as subjects. A senior staff member was contacted at each firm to solicit the individual staff members as subjects and to control the distribution and return of the diskettes and cover letters. Because the firms

25. The first step of data analysis should be a detailed examination of the data. This involves a careful look at the data for compliance with the statistical assumptions.

26. After examining the data carefully, the second step involves the statistical procedures for split-plot ANOVA.

were contacted between December, 1988, and March, 1989, they all requested different return dates for completing the experiment. The contact process was drawn out over four months because the audit season delayed meeting with the contact person. The subjects in each office were limited to audit personnel and management services personnel with accounting experience. The contact person varied from manager to office managing partner. A total of 275 diskettes were distributed, and 117 were returned, representing a 42.5% response rate.

The cover letter was addressed to the contact person in each office. A second page, attached to the cover letter, allowed the subjects to write any additional comments concerning their own method to estimate cash flows from operations and any other comments they wished to communicate to the researcher. Out of the 117 respondents returning the diskettes, 19 subjects (16.2%) returned the cover letter with comments.

DATA RELIABILITY

This experiment identified and examined the theoretical substance of SFAC No. 1. A large sample of subjects was sought to reduce sampling errors, to achieve greater reliability of results, and to increase the power of the statistical tests applied to the data. A computerized instrument ensured that all data provided by the subjects was useful. Obtaining useful data was facilitated by editing checks on subjects' responses as they were doing the experiment. The instrument ensured that the measurement of subjects' responses was accurate, and all subjects' responses were automatically read by a control program to consolidate them into one database. The database was then directly read by SPSS/PC+ to circumvent any transcription errors. This procedure avoided problems with illegible handwriting, incorrectly coded responses, or uncoded responses. The instrument

greatly reduced data mistakes and errors with the analysis. Figure 11 presents a schematic flow of events in processing the diskettes from the subjects. As the diskettes were returned from the various offices, they were read into one data file. From this file the subjects' data were automatically translated to the SPSS/PC file format. This process ensured there would be no transcription errors of data.

DATA EXAMINATION

General

The subjects' data were examined to determine if there were any "gaps."²⁷ For each treatment cell, a standard set of statistical tests was adopted to examine the data for outliers, for normality of the subjects' responses and to determine whether the variance-covariance matrix of the transformed variables produces covariances of 0 and equal variances. This experiment was a split-plot design; therefore, it was necessary to test an additional assumption. The variance-covariance matrices for the transformed variables for a particular effect must be equal for all levels of the between-subjects factors. The examination involved both visual and statistical tests. The visual examination involved the stem-and-leaf plot, the normal probability plot, and the boxplot. The statistical tests were the Shapiro-Wilks and K-S (Lilliefors) test for normality and Cochran's C and the Bartlett-Box F tests for homogeneity of variance. Based on this visual review, parametric tests examined the data for normality and equality of the variance-covariance matrices for all levels of the between-subjects

²⁷ For example, subjects who returned the diskette but did not answer any of the questions, or subjects who provided their estimates of cash flow in millions rather than in thousands.

factors. In the following subsection, an in-depth discussion is presented of the visual and statistical tests for all subjects. The visual discussion concentrates on those subjects allocated to the treatment group 2 and case 3 (refer to Figure 9, page 72). The other cases are presented in Appendix C on page 147.

Stem-and-Leaf Plot

Figure 12 is a stem and leaf plot²⁸ [SPSS/PC+, p. B-18] of the data for the subjects in case 3. This plot indicates visually that the data appears normally distributed. The distribution is unimodal and clustered with ten observations around the range of values 200 to 230. The distribution has a single peak with one extreme value of 433, which was examined for reasonableness. This particular case (subject number 11) was included in the analysis.

FIGURE 12. Stem-and-Leaf Plot .. Case 3

Frequency	Stem &	Leaf
1	0	* 0
4	0	. 6667
4	1	* 0114
6	1	. 577888
10	2	* 0011111223
1	2	. 5
1	3	* 0
1	Extremes	(433)
Stem width: 100		
Each leaf: 1 case		

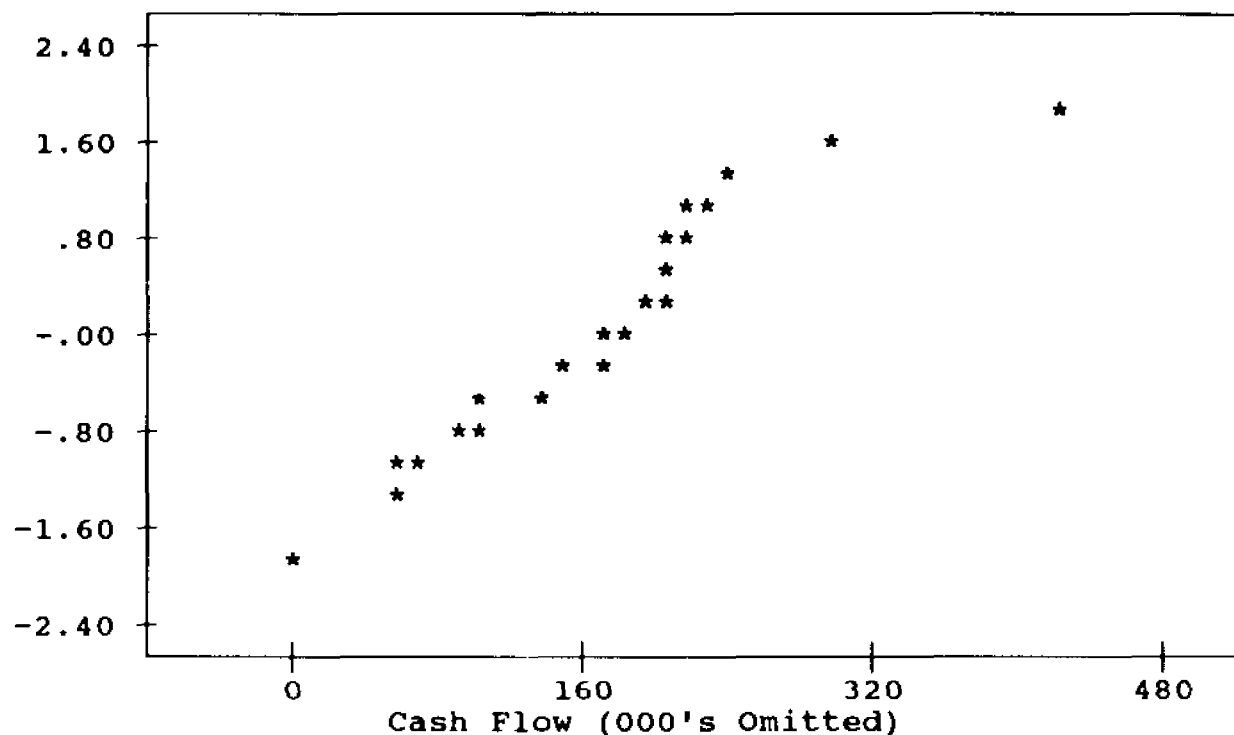
 28. The stem and leaf plot is closely related to the histogram, but provides more information about the actual values than does a histogram.

The length of each row corresponds to the number of cases that fall into the particular interval. The stem-and-leaf plot represents each case with a symbol that corresponds to the actual observed value. This is done by dividing observed values into two components -- the leading digit or digits, called the stem, and a trailing digit, called the leaf. For example, the value 200 has a stem of 2 and a leaf of 0. The hundreds digit is the stem and the leaf is the tens digit. The last digit is ignored. Thus from this stem-and-leaf plot, it is not possible to determine the exact cash flow for a case except for the extreme values.

Normal Plot

The assumption that data comes from a normal distribution is important to statistical inference. Consequently, the stem-and-leaf plot alone is insufficient because it gives only a rough idea of normality of the distribution of a cell. Thus, the second visual examination, the normal probability plot, is performed. This procedure especially assesses normality. A normal probability plot is obtained by ranking the observed values from smallest to largest and then pairing each value with an expected normal value for a sample of that size from a standard distribution. Figure 13 is a normal probability plot for case 3. If the observed estimates of net cash inflows are from a normal distribution, the plot should be approximately a straight line. Since the stem-and-leaf plot (Figure 12) appeared fairly normal, the normal probability plot should be fairly linear, and it is.

FIGURE 13. Normal Plot .. Case 3



Statistical Tests

Normality

Although normal probability plots provide a visual basis for checking normality, it is desirable to statistically test the hypothesis that the data are from a normal distribution. Two statistics for case 3 (Shapiro-Wilks = 0.9345, $df = 28$, $p > 0.0938$, K-S (Lilliefors) = 0.1522, $df = 28$, $p > 0.0956$) were calculated to test for normality. The Lilliefors test is based on a modification of the Kolmogorov-Smirnov test for the situation in which means and variances are not known but must be estimated from the data. From the small observed significance levels, the hypothesis cannot be rejected at the 95% level of confidence. Almost any goodness-of-fit test will result in rejection of the null hypothesis. It is almost impossible to find data that are exactly normally

distributed. For most statistical tests, it is sufficient that the data are approximately normal distributed. Neither test rejects the null hypothesis that the distribution is normal in case 3. Therefore, the data is either from a normal distribution or it does not sufficiently deviate from the normal. These two statistics for all twenty cases were calculated and are summarized in Table 4. After reviewing the results, it was decided that the data for all cases was either from a normal distribution or did not sufficiently deviate from the normal to warrant a transformation of the data.

TABLE 4. Test of Normality					
Shapiro-Wilks			Shapiro-Wilks		
L-S			L-S		
Lilliefors			Lilliefors		
Case			Case		
1	.0561	.1615	11	.0497	.1587
2	.0100	.0059	12	.0724	.2000
3	.0938	.0956	13	.0100	.0163
4	.2274	.2000	14	.1276	.0756
5	.0100	.0002	15	.4573	.2000
6	.1175	.0364	16	.4937	.2000
7	.4049	.2000	17	.7075	.2000
8	.7039	.1740	18	.8337	.2000
9	.1901	.2000	19	.0358	.2000
10	.0433	.2000	20	.0127	.1172

Test Of Homogeneity Of Variance

Univariate Tests

Two univariate homogeneity of variance tests (Cochrans C and the Bartlett-Box F) were calculated. Based on an overall examination of the p values the hypothesis that the variances in the treatment groups are equal need not be rejected. Table 5 presents a summary of these test statistics. Although these univariate tests are a convenient starting point for examining the equality of the covariance matrices, they are not sufficient when a split-plot ANOVA is the experimental design; a test that simultaneously considers both the variances and covariances is required.

TABLE 5. Univariate - Homogeneity Of Dispersion Matrices

Variable .. LEFT25	Left skewed, 25th percentile		
Cochrans C(19,6) =	.41712	$p =$.000 (approx.)
Bartlett-Box F(5,13152) =	3.57463	$p =$.003
Variable .. LEFT75	Left skewed, 75th percentile		
Cochrans C(19,6) =	.24533	$p =$.393 (approx.)
Bartlett-Box F(5,13152) =	.72725	$p =$.603
Variable .. RIGHT25	Right skewed, 25th percentile		
Cochrans C(19,6) =	.29075	$p =$.074 (approx.)
Bartlett-Box F(5,13152) =	2.31959	$p =$.041
Variable .. RIGHT75	Right skewed, 75th percentile		
Cochrans C(19,6) =	.20327	$p =$	1.000 (approx.)
Bartlett-Box F(5,13152) =	.15346	$p =$.979

Multivariate Test

Consequently, Box's M test, which is based on the determinants of the variance-covariance matrices in each cell as well as on the pooled variance-covariance matrix, provides a multivariate test for the homogeneity of the matrices. However, Box's M test is very sensitive to departures from normality. The significance level can be based on either an F or a χ^2 statistic; both approximations are given in the output, as shown in Table 6.

TABLE 6. Multivariate - Homogeneity Of Dispersion Matrices

Boxs M =	151.58413		
F WITH (10,1770) DF =	4.48414	$p =$.000 (Approx.)
Chi-Square with 10 DF =	135.11224	$p =$.000 (Approx.)

Summary of Data Examination

Examination of the data was an essential step in the analysis of the data. Based on such an examination, three subjects were eliminated from the experimental data because each had failed to provide estimates of operating cash flow for the various cases. Consequently, these three subjects were treated as non-responses even though they had returned their diskettes. This section (data examination) involves visually examining the distributions of values for the treatment groups and testing for normality and homogeneity of variance. Given the results of the tests for normality and homogeneity of variance, it was decided to analyze the data using parametric tests and, where appropriate to present the supporting non-parametric equivalent statistic.

STATISTICAL ANALYSIS OF THE HYPOTHESES

General

One hundred seventeen experienced certified public accountants randomly allocated to the six treatment groups, served as participants. Because the participants' placement in groups was random, the treatment groups did not have an equal number of subjects. Unequal group size does not pose a problem, however; it is analytically allowed for in the ANOVA procedure. The demographic characteristics of the one hundred seventeen subjects whose responses were analyzed are summarized in Table 7.

TABLE 7. Demographic Characteristics of Subjects

	Mean	Minimum	Maximum
Age	31	23	51
Years of experience	7	2	28
Level of education	Undergraduate	Masters	
	93	24	

In a split-plot ANOVA involving four factors -- two factors between-subject and two factors within-subject -- it is possible to answer fifteen questions: four concerned with main effects, six with first-order (two-way) interactions, four with second-order (three-way) interactions, and one with fourth-order (four-way) interaction. In this experiment six hypotheses were investigated; they could be confirmed by the statistical results in the ANOVA table reported in Table 8 (p. 89). The first hypothesis relates to the impact of the two intersubject factors, format and scaling, and to their interaction with the skewness factor.

This first hypothesis is of primary interest in this research, while the remaining five hypotheses were of secondary importance. The experimental design, the task required of the subjects, and the levels of the variables examined were chosen to provide evidence for this major hypothesis. Knowledge of the interaction among the three factors (scaling, format and skewness) is more useful than knowledge of the main effects [Montgomery, 1984, p. 191]. Also, examining the factors individually may lead to misleading conclusions. Concentrating on this third-order interaction allows effects of the scaling factor (point-estimate and probabilistic) to be estimated at the two levels of the format factor (tabular and graphical) and of the skewness factor (left and right skewed), yielding conclusions that are valid over a range of experimental conditions [Montgomery, 1984, p. 192]. In a three-factor study (hypothesis 1), the three-factor interaction is defined as the difference between the treatment mean and the value that would be expected if main effects and first-order interactions were sufficient to account for all factor effects. The presence of three-factor interactions implies that at least some of the specific two-factor interactions for any two factors differ, depending on the level of the third factor. If three-factor interactions are present, the interactions between any two factors need to be studied separately for each level of the third factor [Neter, Wasserman, & Kutner, 1985, p. 805].

Hypotheses 2 and 3 pertain to the simple main effects of the individual factors scaling and format. The last three hypotheses relate to the two intrasubject factors. Results from the debriefing questionnaire are also presented. Each hypothesis will be answered in terms of the ANOVA results presented in Table 8.

TABLE 8. ANOVA Table For Format, Scaling, Skewness and Percentile

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Sig. of F</i>
Between-subjects					
Scale	2	35,493.07	17,746.54	.57	.568
Format	1	1,741.18	1,741.18	.06	.814
Scale By Format	2	744.41	372.21	.01	.988
Error-between	111	3,464,466.13	31,211.41		
Within-subjects					
Skewness	1	6,937.25	6,937.25	2.19	.142
Scale By Skewness	2	11,292.57	5,646.28	1.78	.173
Format By Skewness	1	7,037.16	7,037.16	2.22	.139
Scale By Format By Skewness	2	7,143.67	3,571.83	1.13	.328
Error-within	111	351,672.03	3,168.22		
Percentile	1	731,030.92	731,030.92	130.93	.000 **
Scale By Percentile	2	4,366.03	2,183.01	.39	.677
Format By Percentile	1	11,315.13	11,315.13	2.03	.157
Scale By Format By Percentile	2	45,649.36	22,824.68	4.09	.019 **
Error-within	111	619,739.95	5,583.24		
Skewness By Percentile	1	2,179.42	2,179.42	1.77	.186
Scale By Skewness By Percentile	2	9,858.90	4,929.45	4.00	.021 **
Format By Skewness By Percentile	1	2,845.25	2,845.25	2.31	.132
Scale By Format By Skewness By Percentile	2	4,107.39	2,053.69	1.67	.194
Error-within	111	136,899.08	1,233.33		

** = Significant at the 5% level.

* = Significant at the 10% level.

Hypothesis 1

This hypothesis was of primary concern in this research, for the fundamental question at issue will be answered by the acceptance or rejection of this hypothesis. Hypothesis 1 pertains to the interaction between format, scaling and skewness characteristics. The hypothesis states that the estimate of cash flow from operations will be higher when the decisionmaker has both graphical and probabilistic data and that the more positive this data, the higher the estimate will be.

Restating hypothesis 1:

- H_1 When a material uncertainty is indicated, the estimate of prospective net cash inflows increases when probabilistic and graphical data about the uncertainty is disclosed, and will be higher when the supplemental data concerning the uncertainty is positive.

The hypothesis projected that the format and scaling factors would interact with the skewness factor in such a way as to produce a higher estimate of cash flow when the supplemental data concerning the uncertainty is positive. Specifically, when the skewness is left skewed, the supplemental data is more positive than when the supplemental data is right skewed. Therefore, the expected mean estimate of cash flow from operations should be higher when the subject is presented with probabilistic, graphical, and left skewed data than when presented with probabilistic, graphical, and right skewed data. The interaction between scaling and format and skewness was not significant ($F = 1.13$, $p < 0.328$). The levels chosen for the skewness factor may have contributed to this lack of statistical significance (refer to hypothesis 6, page 102).

Although the interaction was not significant, examining the data for the skewness factor indicates that the subjects did respond in ways which indicate that their estimate of cash flow was affected by the skewness of the distribution of the accounts receivable balance. The boxplots²⁹ in Figures 15, 16, 18, and 19³⁰ clearly indicate that the subjects

responded correctly in most situations to the skewness factor. For example, Figure 15 contains boxplots of the subjects' responses in Group 2 - Probabilistic/Familiarize and Tabular. From this plot and the accompanying data table, one can observe that the left skewed average value is higher than the right skewed average value. To facilitate understanding the boxplots, the data is summarized in Table 9. The means of the estimated cash flow and the direction of the differences are presented in Table 9.

TABLE 9. Mean Differences And Skewness
Estimated Cash Flow
(000's Omitted)

<u>Treatment Group (percentile)</u>		<u>Left</u>	<u>Right</u>	<u>Direction</u>	<u>C - W*</u>
Probabilistic/Familiarize and Tabular	(25th)	175	168	Correct	8 - 20
	(75th)	281	281	No effect	6 - 22
Probabilistic and Tabular	(25th)	165	174	Incorrect	3 - 21
	(75th)	236	233	Correct	6 - 18
Probabilistic/Familiarize and Graphical	(25th)	236	164	Correct	8 - 6
	(75th)	245	236	Correct	10 - 4
Probabilistic and Graphical	(25th)	155	150	Correct	8 - 5
	(75th)	255	246	Correct	10 - 3

* = Number of subjects either correct (C) or wrong (W) in the direction of change.

29. A boxplot displays summary statistics for the distribution of subject responses. It plots the median, the 25th percentile, the 75th percentile, and values that are far removed from the rest. Referring to Figure 14, the lower boundary of the box is the 25th percentile, and the upper boundary is the 75th percentile. The asterisk in the box represents the median. Fifty percent of the cases have values within the box. The length of the box corresponds to the interquartile range, which is the difference between the 25th and 75th percentile. The largest and smallest observed values that aren't outliers are also shown. Lines are drawn from the ends of the box to these values. (These lines are sometimes called whiskers, and the plot is called a box-and-whiskers plot.) These plots (Figures 14, 15, 16, 17, 18 and 19) were presented because from the median one can determine the central tendency or location, and from the length of the box the spread, or variability. If the median is not in the center of the box, the observed values are skewed.

30. Figures 14 and 17 are not relevant because they are the control groups and did not receive the skewness factor.

In effect, this table shows that when the subject received graphical data to clarify the uncertainty, the decision in all situations was a higher cash flow for the left skewed distribution as predicted by the hypothesis. When the supplemental data was tabular, the results were mixed. In two of the situations the subjects estimated a higher cash flow when the supplemental data was positive (left skewed). However, in one case the direction of the change in the means was opposite to the prediction of the hypothesis, and in the remaining situation there was no difference. One concludes that the subject will change the estimate of cash flow from operations when supplemental information is provided to clarify the uncertainty of a financial variable which directly impacts the cash flow cycle, and the estimate will be higher if the supplemental data is graphical and probabilistic. However, the change in the estimate will not be statistically significant based on the levels of the factors examined in this study.

Both the format and scaling variables are called dichotomies or dichotomous variables. The levels to be examined are clearly definable. The skewness variable is a continuous variable, capable of taking on an ordered set of values within a certain range. Effectively, this range is from a right-angled triangular distribution through to a left-angled triangular distribution. For this research it was considered unreasonable to take the extreme end points for examination. Instead, distributions skewed so that the difference had a marked effect on cash flow were selected. The results of hypothesis 6 indicate that the procedure to operationalize this skewness factor was not sufficient to generate a statistically significant result. Additional research could study the degree to which the skewness will statistically affect the decisionmakers' estimate of cash flow.

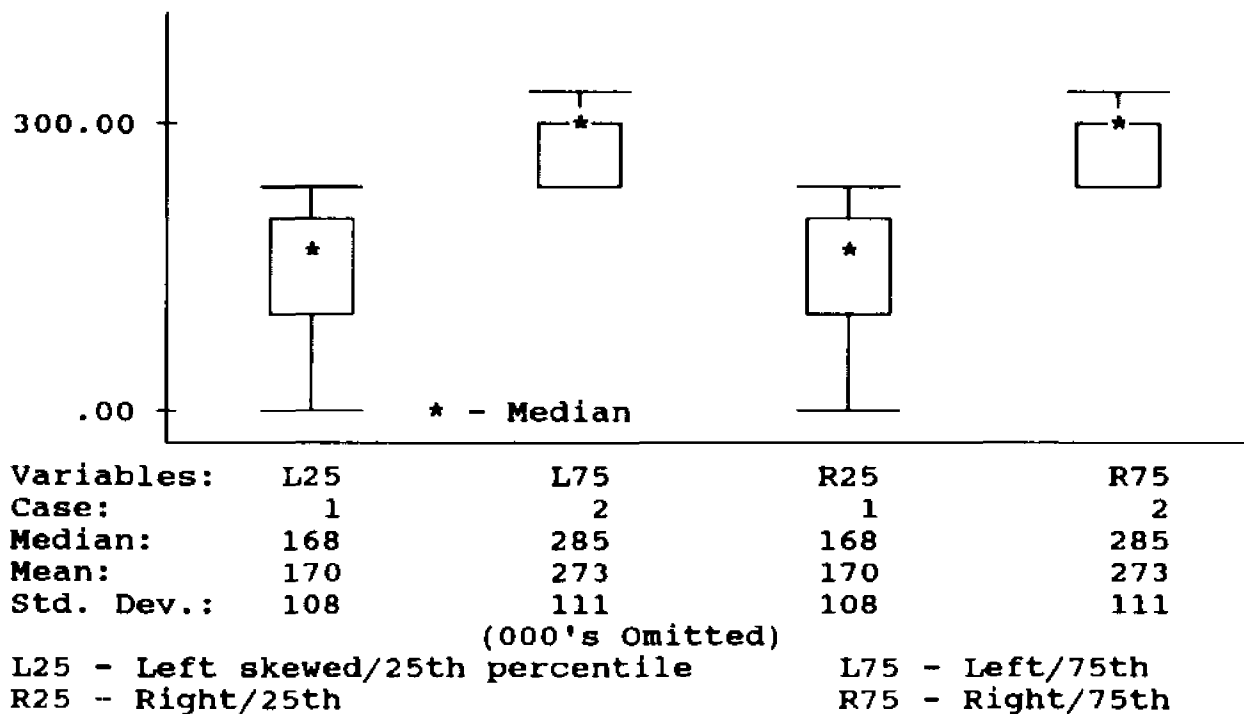
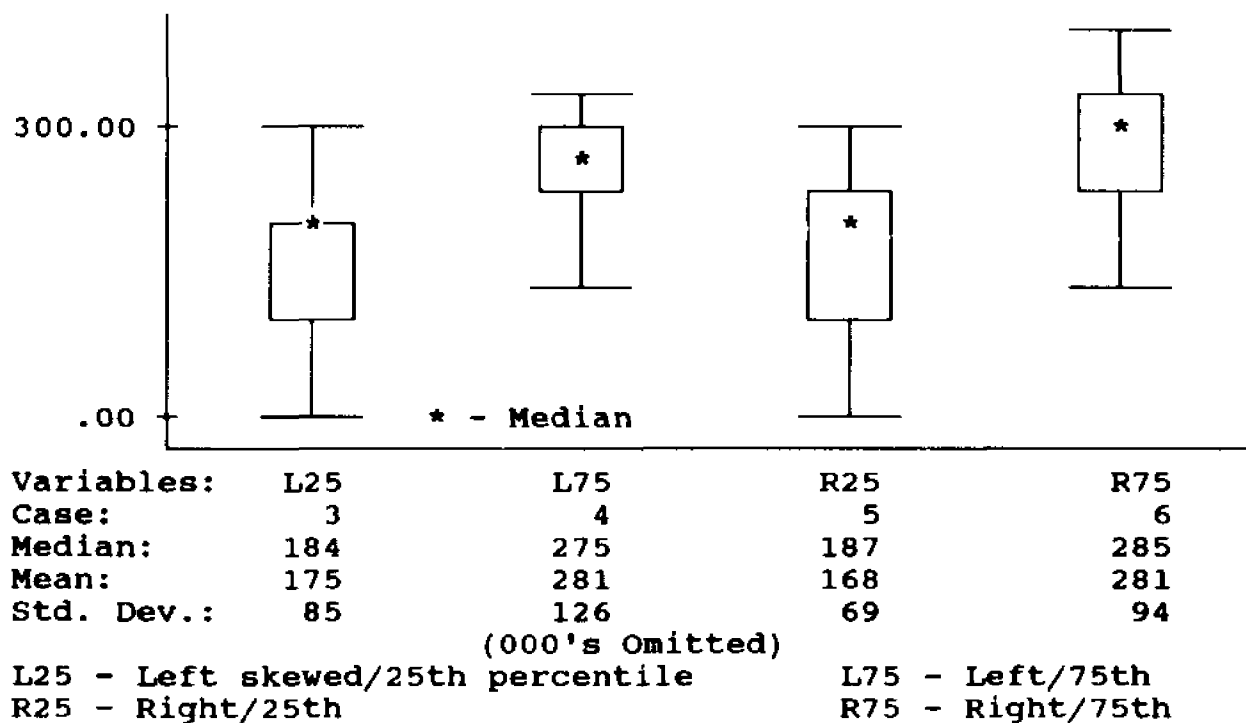
FIGURE 14. Model: Group 1 - Point Estimate and Tabular**FIGURE 15. Model: Group 2 - Probabilistic/Familiarize and Tabular**

FIGURE 16. Model: Group 3 - Probabilistic and Tabular

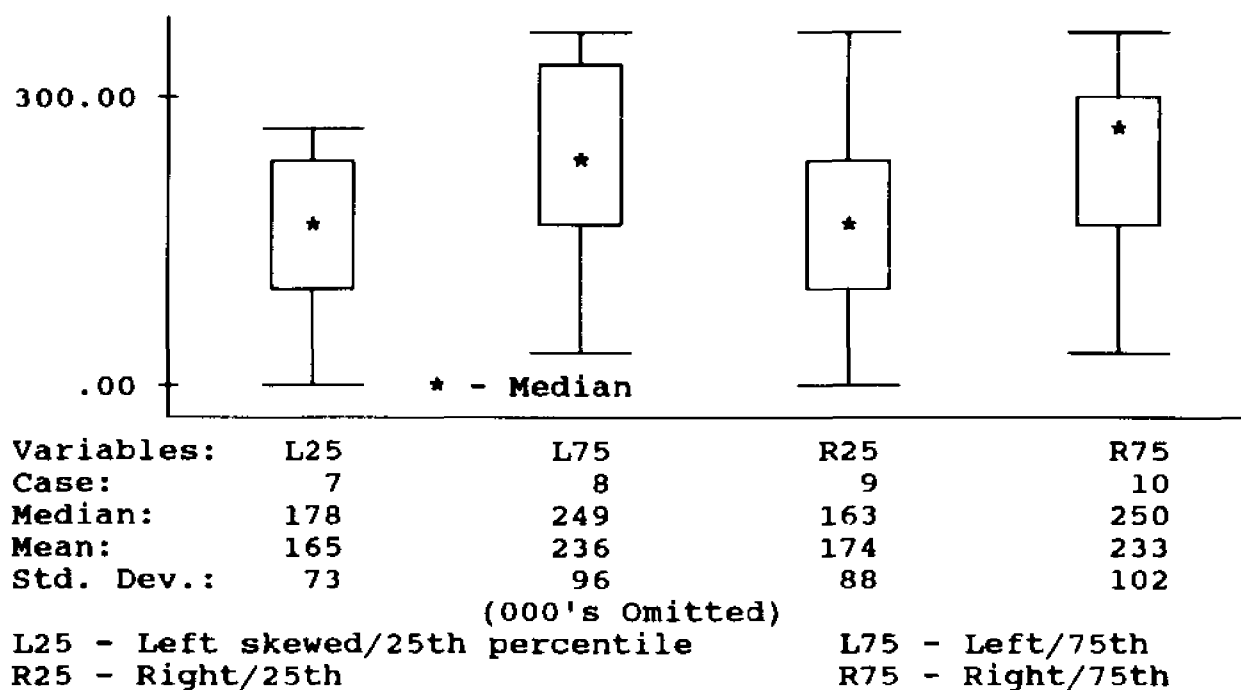


FIGURE 17. Model: Group 4 - Point Estimate and Graphical

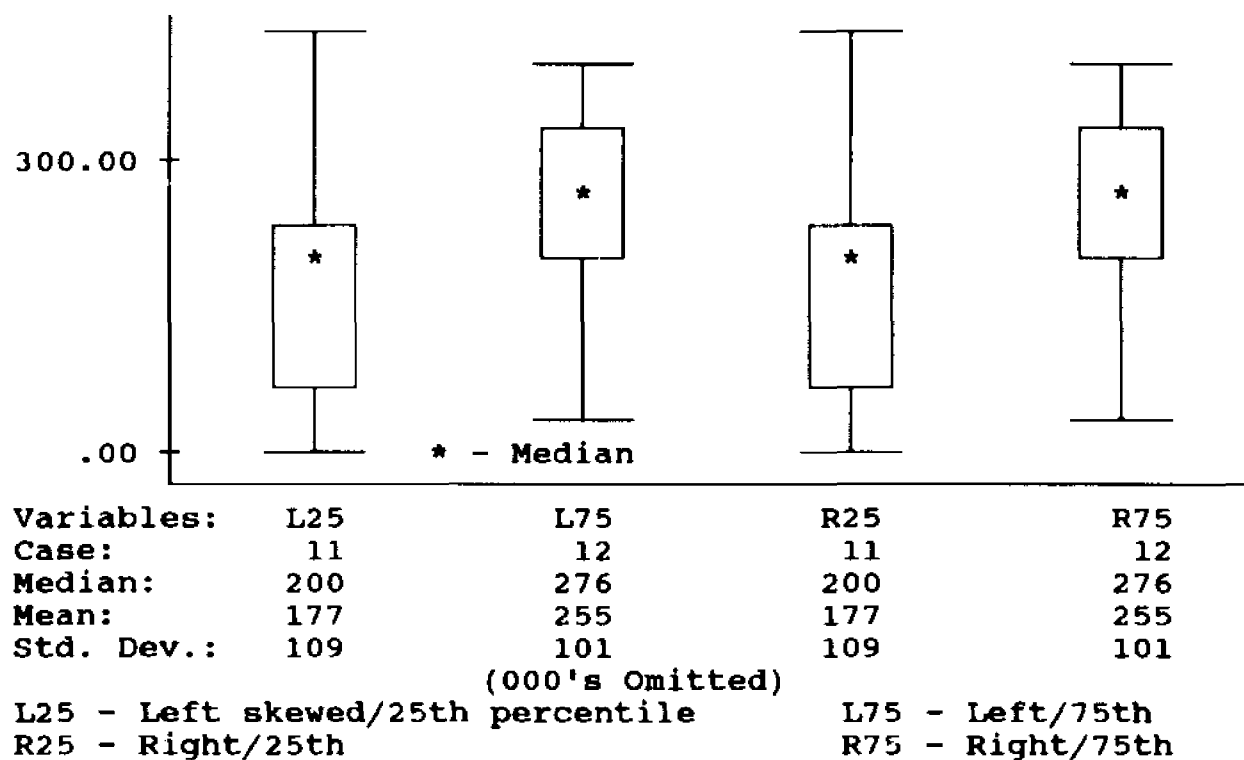
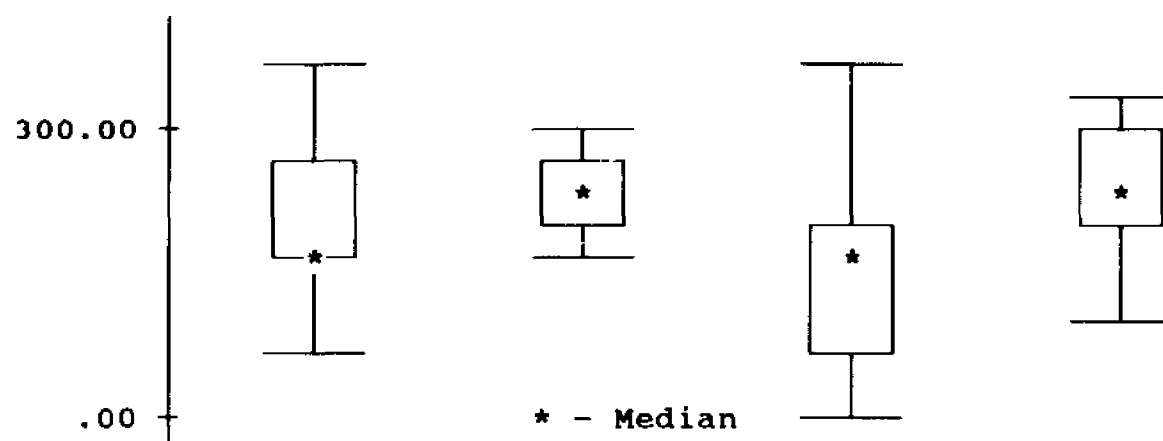


FIGURE 18. Model: Group 5 - Probabilistic/Familiarize and Graphical

Variables:	L25	L75	R25	R75
Case:	13	14	15	16
Median:	179	234	183	242
Mean:	236	245	164	236
Std. Dev.:	173	102	128	103

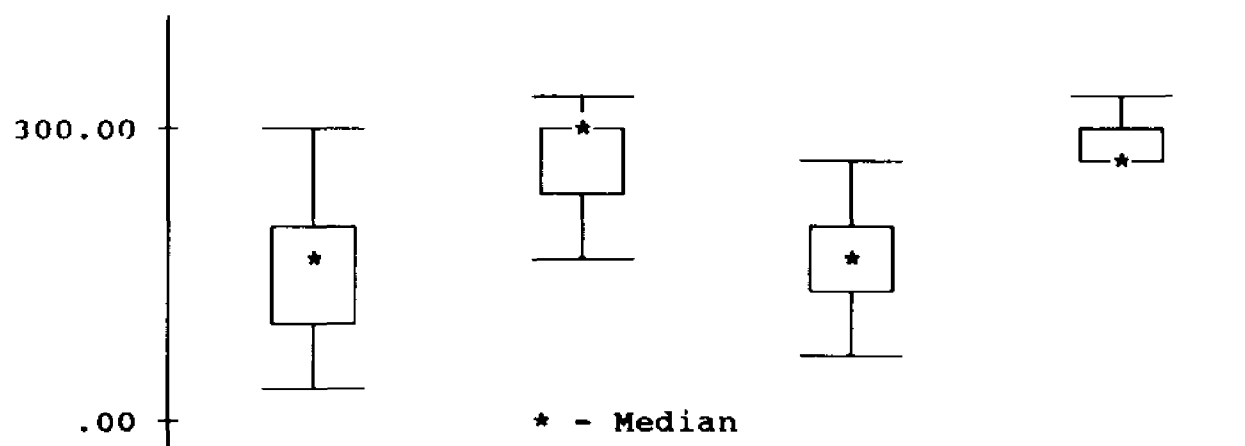
(000's Omitted)

L25 - Left skewed/25th percentile

L75 - Left/75th

R25 - Right/25th

R75 - Right/75th

FIGURE 19. Model: Group 6 - Probabilistic and Graphical

Variables:	L25	L75	R25	R75
Case:	17	18	19	20
Median:	155	290	155	277
Mean:	155	255	150	246
Std. Dev.:	77	83	65	92

(000's Omitted)

L25 - Left skewed/25th percentile

L75 - Left/75th

R25 - Right/25th

R75 - Right/75th

Nevertheless, the subjects were cognizant of the interactive effects of format, scaling and skewness. When the subject received graphical and probabilistic financial data to clarify an uncertainty in the financial statements, the subject was more optimistic of prospective net cash flows when the data was positive (left skewed) than when it was less positive (right skewed). Referring to table 9, one sees that in six out of the eight cases, the subjects made the correct decision. The paradigm for the subjects' decisionmaking is correct, but the difference is not statistically significant. Besides the insufficient dissimilarity in the left and right skewness, it is also possible that the lack of a statistically significant difference is due to the nature of the subjects; accountants are basically conservative. Nevertheless, these results have profound importance, for they provide substantive empirical evidence supporting the premise of SFAC No. 1 and its predecessors ASOBAT and Trueblood.

Hypothesis 2

The second hypothesis seeks to establish more evidence for graphical presentations. Historically, the empirical evidence has produced mixed results.

Restating hypothesis 2:

- H_2 When supplemental data about a material uncertainty is disclosed, the estimate of prospective net cash inflows will be higher for graphical information than for tabular information, and will be higher when the supplemental data concerning the uncertainty is positive.

The interaction between format and skewness was not significant ($F = 2.22$, $p < 0.139$). Also, a simple main effects analysis indicated the graphical level is not significantly different from the tabular level ($F = 0.06$, $p = 0.814$)³¹.

31. In case possible violation of the assumption of the ANOVA masked a significant effect, the between-groups format factor was tested separately for each level of the intrasubject factors using the Mann-Whitney U-test. None of the tests was significant. The results are reported in Appendix D, page 168.

These results are not surprising because the research literature has found mixed results. Generally, the literature indicates that tabular reports lead to more accurate decision making, and graphical reports lead to faster decision making in low time-pressure environments. A major confounding factor in experiments involving graphical material is the rapid change in technology that facilitates presenting financial data in numerous graphical formats. For example, over the last ten years the advancement in software and hardware technology has made graphical presentations available to most decisionmakers using financial statement data. In particular, the subjects used in this experiment were sampled from firms that regularly use integrative software packages³² allowing decisionmakers to present financial data both in tabular format and immediately in numerous graphical formats in either monochrome or color. Since this experiment was primarily interested in clarifying the reporting uncertainty and the scaling of the numbers in financial statements, it was therefore necessary to examine the format for presenting the change in the scaling of financial statement data.

Hypothesis 3

The numbers in financial statements are point-estimates -- single numbers that represents management's best single-valued estimate of the quantity being measured. Consequently, one cannot say that the point estimate is the one and only exact measure. Other point estimates could be obtained from other samples of the same size whose means were different. Such samples are assumed to be taken from a normal distribution, that is, a symmetrical continuous distribution. If these means were normally distributed, a large family of point estimates could be calculated which would also be normally

³². For example, Lotus 1-2-3, Excel and Harvard Business Graphics.

distributed. In fact, the distributions of financial variables are not normally distributed. This observation is the basic issue behind ASOBAT, Trueblood, and SFAC No. 1. Financial formation needs to be provided to decisionmakers to eliminate or reduce the uncertainty of making estimates of prospective net cash inflows.

This third hypothesis was of concern because it deals with the fundamental question at issue in this experiment. If reporting uncertainty is reduced, will the decisionmaker make a different estimate of the cash flow from operations? Also, will the change in the estimate be in the correct direction?

Restating hypothesis 3:

- H_3 When supplemental data about a material uncertainty is disclosed, the estimate of prospective net cash inflows will be higher for probabilistic information than for point-estimate information, and will be higher when the supplemental data concerning the uncertainty is positive.

The interaction between scaling and skewness was not significant ($F = 1.78$, $p < 0.173$). Also, a simple main effects analysis indicated that within the scaling factor, there is no significant difference among the three levels examined ($F = .57$, $p = 0.568$).³³ That the difference was not statistically significant can be attributed to various circumstances and will be the subject of future research. One explanation is that the subjects are traditionally conservative because of their training, and they quite possibly estimated the cash flow from the left skewed distribution very conservatively. Even though the task was very specific, the subjects were asked to estimate the cash flow from operations, and their debriefing questionnaire indicated that the experiment instructions were very clear (78%), the majority of the subjects (85%) indicated that they

33. In case possible violation of the assumption of the ANOVA masked a significant effect, the between-groups scaling factor was tested separately for each level of the intrasubject factors using the Kruskal-Wallis test. None of the tests was significant. The results are reported in Appendix E, page 170.

needed additional information to complete the task. Reviewing the subjects' written comments, a frequent comment was that they needed *the budget*. This information request seems a little incongruous in light of the assigned task, which was to produce the net effect of the cash flow budget; to provide the budget would have defeated the task and the purpose of the experiment. The cues provided to estimate the cash flow were all the cues that are available to decisionmakers outside the organization. Perhaps the results will be different when a different focal population is sampled to perform the experiment; bank loan officers, a focal population more attuned to making decisions outside the organization about cash flows, might prove an interesting subject group.

Hypotheses 4, 5 and 6 were of secondary importance. They either provided support for the first three hypotheses or contributed to the verification of the reliability and validity of the experimental data. Hypotheses 4 considers the interaction between the two intrasubject factors (skewness and percentile), hypothesis 5 the simple main effects of financial statement percentile, and hypothesis 6 the simple main effects of distribution skewness.

Hypothesis 4

The levels of the skewness and percentile factors were chosen so that the most favorable cash flow for the 25th percentile (i.e., the left skewed distribution) would be comparable with the most unfavorable cash flow for the 75th percentile (i.e., the right skewed distribution).

Restating hypothesis 4:

- H₄** The estimate of prospective net cash inflows will be higher for the 75th percentile financial statements and left skewed distribution than for the 25th percentile financial statements and right skewed distribution.

A statistically significant interaction does not appear among the two levels of the percentile factor and the two levels of the skewness factor ($F = 1.77$, $p < 0.186$). The objective of this hypothesis to some extent conflicted with the objectives of the first three hypotheses, for operationalizing the skewness factor required that the distribution not be too dissimilar, thereby conflicting with the objectives of hypotheses 1 and 3 where the skewness levels may not have been dissimilar enough. Reviewing Table 10 indicates that the subjects did make their estimates of cash flow cognizant of the percentile and skewness factors.

**TABLE 10. Mean Differences And Skewness
Estimated Cash Flow
(000's Omitted)**

<u>Treatment Group (percentile)</u>		<u>Difference</u>	<u>Direction*</u>
Probabilistic/Familiarize and Tabular	from left-25th to right-75th	from 175 to 281	Correct (24-4)
	from right-25th to left-75th	from 168 to 281	
Probabilistic and Tabular	from left-25th to right-75th	from 165 to 233	Incorrect (19-5)
	from right-25th to left-75th	from 174 to 236	
Probabilistic/Familiarize and Graphical	from left-25th to right-75th	from 236 to 236	Correct (9-5)
	from right-25th to left-75th	from 164 to 245	
Probabilistic and Graphical	from left-25th to right-75th	from 155 to 246	Correct (11-2)
	from right-25th to left-75th	from 150 to 255	

* = In brackets are the number of subjects either correct (C) or wrong (W) in the direction of change (i.e. (C - W)).

In three out of the four within-subject treatment groups, the direction of change in the mean estimate of the cash flow was in the correct direction. The subjects who received the tabular and probabilistic financial data made their adjustment to cash flow estimates contrary to the definition of the levels of the variables (i.e., percentile and skewness). Again, the results indicate that the subjects familiarized with decisionmaking under uncertainty will correctly estimate the level of the cash flow when presented with percentile and skewness financial statement data.

Hypothesis 5

The levels of the financial statements were based on the Robert Morris Associates' annual statement studies 25th and 75th percentiles.

Restating hypothesis 5:

H_5 The estimate of prospective net cash inflows will be higher for the 75th percentile financial statements than for the 25th percentile financial statements.

A simple main effects analysis indicated that within the percentile factor, the estimated cash flow for the 75th percentile was significantly higher than the 25th percentile ($F = 130.93$, $p = 0.000$). However, the results indicate that there was a significant interaction ($F = 4.09$, $p < 0.019$) between scaling and format and the percentile of the case data. The subjects did associate a higher cash flow with probabilistic and graphical data, and the more positive the data, the higher their estimate was of the cash flow from operations. This is consistent with what was predicted by the hypothesis. The more positive the elucidation of the uncertainty, the more positive the estimated cash flow. Examining the boxplots in Figures 14, 15, 16, 17, 18, and 19 clearly indicates that the subjects responded as predicted by the hypothesis in regard to the percentile factor. In

all six figures, the cash flow associated with the 75th percentile case data was both significantly different and also in the correct direction (i.e. higher) than for the 25th percentile case data.

Hypothesis 6

The fundamental purpose of the research was to investigate the effect on decisionmakers' estimates of prospective net cash inflows as a result of changing the format and scaling of financial statement data. Changing the scaling of financial statement data adds another dimension, namely the skewness of the numbers presented to the decisionmakers. The potential skewness is a continuous variable; therefore, it was decided to choose two levels of skewness that indicate opposite outcomes for the prospective cash flow. Left and right skewed distributions were chosen for the balance of accounts receivable so that they would have a material effect on the cash flow generated through the normal collection process.

Restating hypothesis 6:

H_6 The estimate of prospective net cash inflows will be higher for left skewed distribution financial statement data than for right skewed financial statement data.

A simple main effects analysis indicated that within the skewness factor, the estimated cash flow for the left skewed distribution was not significantly higher than for the right skewed distribution ($F = 2.19$, $p = 0.142$). Examining the boxplots and means in Figures 15, 16, 18 and 19 indicates that the subjects were mindful of the skewness data provided in the cases and in the majority of the cases acted on this data correctly. When the distribution was skewed right, the subjects' estimate of cash flow from operations was less than when the distribution was skewed left. Because the distributions had the same

mean values (that means they represented the same point-estimates), the statistical procedure to analyze the results (ANOVA) may not have been powerful enough. These results afford the opportunity for future research.

Other Effects

The primary analysis was conducted based on a second-order interaction, namely the interaction between scaling, format, and skewness. Higher order interactions are possible but difficult to interpret. Table 8 indicates one third order interaction; although statistically significant and theoretically possible, it is difficult to interpret. The fundamental statistic of importance in this research was the second-order interaction between scaling, format and skewness. When complex relations are found, it is important to replicate the research. If the results of the replication are consistent with the original research, the interaction is probably not due to chance [Kerlinger, 1986, p. 240].

Additional Comments From Subjects After Experiment

The subjects were provided with a sheet of paper (Appendix A, page 130) to provide additional comments after the experiment was completed. Nineteen subjects (16%) returned the sheet. The comments have been reproduced in Appendix F, page 173. Most subjects indicated that they would have preferred additional information, especially information relating to management projections (budgets) about the income statement. Yet the experiment focused on SFAC No. 1, which is specifically directed towards external financial reporting. It is not customary to report management projections and budgets outside the organization; the purpose of the experiment was to determine whether changing the format and scaling characteristics of financial statement

data would facilitate making projections about the cash flow from an organization when the decisionmaker is not permitted the luxury of access to the management projections and budgets.

Other Information Gathered From The Subjects

After the completion of the cases, the subjects were asked numerous questions about the experiment itself. The questions are presented in their entirety in Appendix B, page 131.

Question 1 of this debriefing questionnaire asked the subjects about their awareness of the conceptual framework pronouncements. The vast majority of subjects were aware of the conceptual framework agenda:

Familiar with SFAC's

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	9	7.7	7.7
Yes	108	92.3	100.0
	-----	-----	
TOTAL	117	100.0	

Questions 2 and 3 asked the respondents directly about their familiarization with SFAC's Nos. 1 and 2. A large percentage of subjects were not familiar with either SFAC No. 1 or SFAC No. 2.

Familiar SFAC # 1:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	54	46.2	46.2
Yes	63	53.8	100.00
	-----	-----	
Total	117	100.0	

Familiar SFAC # 2:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	56	47.9	47.9
Yes	61	52.1	100.0
	-----	-----	
TOTAL	117	100.0	

Question 4 inquired whether the subject needed additional information to complete the task of estimating the cash flow from operations. The majority of subjects felt they needed additional information to perform the task. Their comments are detailed in Appendix G, page 177.

Needed additional information:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	18	15.4	15.4
Yes	99	84.6	100.0
	-----	-----	
TOTAL	117	100.0	

Question 5 asked if the subjects were comfortable making the estimate of cash flow. The majority of subjects (81%) indicated they were not comfortable making the estimate.

Comfortable making estimate:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	95	81.2	81.2
Yes	22	18.8	100.0
	-----	-----	
TOTAL	117	100.0	

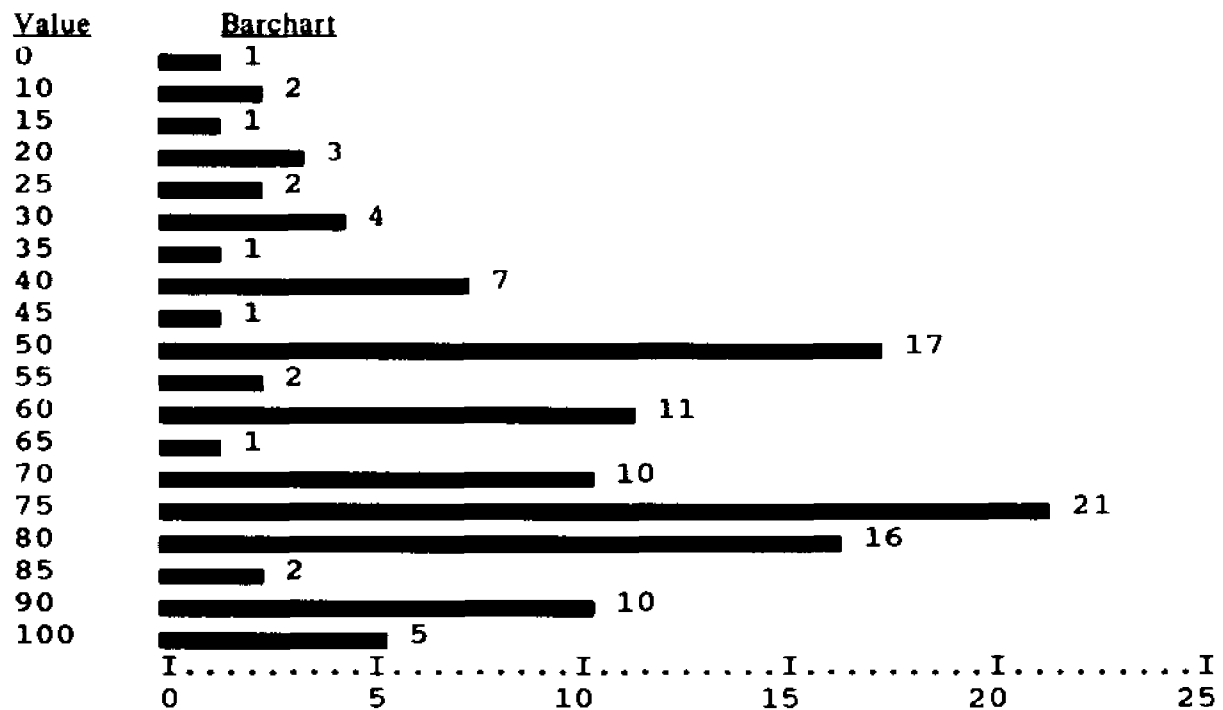
Question 6 sought the subjects' attitude toward risk compared to their colleagues' attitude. The results to this question help to explain why there was not a significant difference to the skewness main effect. The subjects responded conservatively to their estimate of cash flow.

Attitude to risk:

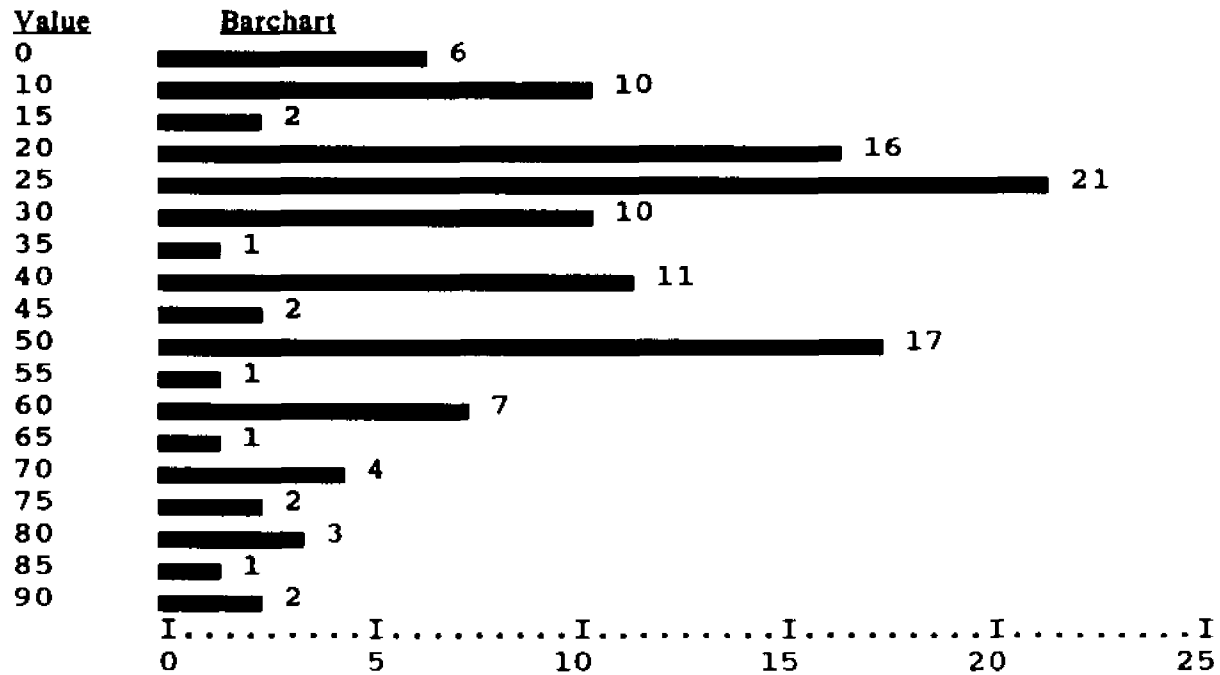
<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
Much less willing	15	12.8	12.8
About average	91	77.1	90.6
Much more willing	11	9.4	100.0
	-----	-----	
TOTAL	117	100.0	

Questions 7 and 8 reviewed the subjects' reliance on traditional and non-traditional information in the case. The following two barcharts present the data for question 7 and 8.

Traditional information



Non-Traditional information



Question 9 asked the subjects how interesting they found the experiment. The subjects generally found the experiment to be interesting.

Interesting experiment:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
Very dull	13	11.1	11.1
Dull	43	36.8	47.9
Interesting	61	52.1	100.0
<hr/>			
TOTAL	117	100	

Question 13 inquired as to whether the instructions were clear. The majority (79%) thought the instructions were clear.

Instructions clear:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	25	21.4	21.4
Yes	92	78.6	100.0
	-----	-----	
TOTAL	117	100	

Question 14 asked if the subject made notes during the experiment.

Most made notes during the experiment:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
No	17	14.5	14.5
Yes	100	85.5	100.0
	-----	-----	
TOTAL	117	100	

Question 15 solicited the subjects' estimate of the elapsed time of the experiment. Table 11 contains output from a paired t test. The mean difference is the difference between the mean scores for the actual versus estimate of elapsed time. The t value is the mean difference divided by the standard error of the difference ($3.8644/3.273 = 1.20$). The two-tailed probability for this test is .223, so there is insufficient evidence to reject the null hypothesis that actual elapsed time and estimated elapsed time have similar means.

TABLE 11. T-Test For Actual Time Versus Estimated Time

Paired samples t-test: ACTTIME ESTTIME		Actual elapsed time experiment Estimate elapsed time of experiment		
Variable	Number of Cases	Mean	Standard Deviation	Standard Error
ACTTIME	117	36.0011	33.991	3.142
ESTTIME	117	32.1368	11.676	1.079

Mean	Standard Deviation	Standard Error	Corr.	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
3.8644	34.863	3.223	.096	.303	1.20	116	.233

All subjects in groups 2 and 5 received the tutorial on decision making about uncertainty. The following table summarizes the results of the test administered to each subject. All subjects got the right answer. The zero value in the table represents the subjects who did not receive the education.

Education - amount greatest chance:

	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
0	98		83.8
2800	1		84.6
2890	1		85.5
2900	1		86.3
2990	16		100.0

TOTAL	108		

Education - choose between amounts:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
N	18	94.7	94.7
Y	1	5.3	100.0
	-----	-----	
TOTAL	19	100	

Each subject could have changed his or her answer before continuing. All subjects were confident enough with their answers to continue. Two subjects found it necessary to erase their answers and try again.

Education - number times change answers:

<u>Value Label</u>	<u>Frequency</u>	<u>Percent</u>	<u>Cum Percent</u>
0	75	64.1	64.1
1	40	34.2	98.3
2	2	1.7	100.0
	-----	-----	
TOTAL	117	100	

All subjects were given the opportunity to request a summary of the results.

Appendix B (page 131) presents the screen on which the subjects could enter their name and address directly into the system. A total of 44.4% of the subjects provided their name and address to receive a summary of the results.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

This chapter summarizes the experiment reported in previous chapters and draws on that experiment to form conclusions about format and scaling characteristics of financial statement data and to make suggestions for the future. Questions of the type stated below are the subject of this chapter:

Are current accounting practices for presenting financial statement data adequate for estimating the amount, timing and uncertainty of prospective net cash inflows?

While not claiming to conclusively answer such a question, the results obtained in this experiment help to shed at least some light on the need for changes in the presentation of financial statement data and the need for additional research.

This chapter begins with a summary of the experiment reported in previous chapters. This is followed by sections on the conclusions of the experimental results and concludes with recommendations for future research.

Summary

Financial statements present single quantities computed from sample data to estimate an unknown population characteristic. These single numbers are tagged point-estimates by accountants and represent the best single-valued estimate of the quantity being measured. Such numbers result from measurements based on rules and conventions, rather than exact amounts, and imply a high degree of precision; actually, the numbers are very uncertain for two reasons: (1) the statistical uncertainty inherent in

financial variables best described by a probability density function, and (2) the reporting uncertainty of reducing the probability density function to a point-estimate for financial statement presentation. This latter uncertainty for decisionmakers has been cause for concern to both academics and practitioners, evoking various recommendations to change the format and scaling of financial statement data.

Numerous suggestions have been made for presentation changes, the most notable being ASOBAT³⁴ that recommended financial statements disclose *interval estimates or probability distributions*. Then the Trueblood Committee Report³⁵ recommended that financial statements present *possible ranges and dispersions*. Finally, the most important pronouncement came from the Financial Accounting Standards Board in its statement Objectives of Financial Reporting by Business Enterprises (SFAC No. 1) which states [1978, par. 36]:

financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise.

In this significant statement the FASB announced that the conceptual framework³⁶ was to provide a theoretical foundation for the development of future accounting standards. These pronouncements recognize the problems of decisionmakers faced with the uncertainty of data in financial statements.

When uncertainty exists, decisionmakers are known to rely on heuristics: (1) representativeness, (2) availability, and (3) adjustment from an anchor. These heuristics, although highly economical and usually effective, lead to systematic and predictable

34. A Statement of Basic Accounting Theory by the American Accounting Association, 1966.

35. Objectives of Financial Statements by the American Institute of Certified Public Accountants, 1973.

36. SFAC No. 1 was only the first of six statements comprising the conceptual framework to be announced by the FASB.

errors. To improve business decisionmaking, one essentially has a choice (or combination) of three options: (1) change the information, (2) educate the decisionmaker to change the processing of information, (3) replace the decisionmaker with a model. This research studied how reducing reporting uncertainty by changing the information (format and scaling characteristics) and by educating the decisionmaker to rely less on heuristics (effective assimilation of the supplemental information on uncertainty) influences decisionmaking.

Depending on the treatment group, some subjects were sensitized to decisionmaking under uncertainty. This was necessary because decisionmakers are not Bayesian experts. Currently, financial statements have a tabular format with a point-estimate scaling. This presentation forms the basis of the reporting uncertainty. To reduce or eliminate such reporting uncertainty would necessitate presenting probabilistic data, which lends itself to either a graphical or tabular presentation.

Subjects from six of the "Big 8" accounting firms took part in an experiment to manipulate the format and scaling characteristics of financial statement data. The subjects were required to estimate the net cash flow from operations for a hypothetical case based on the 1987 Robert Morris Associates annual statement studies for a physicians' office. The subjects had to use numerous cues in order to make judgments about the cash flow.³⁷ Depending on the treatment group, some subjects received the tutorial and either the traditional point-estimate and tabular presentation, or supplemental financial data that was either graphical (format) or probabilistic (scaling), or a combination of graphical and probabilistic. The purpose of the graphical and probabilistic financial data was to reduce the reporting uncertainty.³⁸ Also, the

37. Cues that are readily available to decisionmakers outside the enterprise, e.g. creditors and investors.

38. To reduce the reporting uncertainty necessitates providing information about the probability density function, whereas to reduce the statistical uncertainty necessitates reducing the variance.

experimental design involved a repeated measure; each subject was exposed to the 25th and 75th percentile RMA financial data and the left and right skewed distributions. The format and scaling factors were treated as between-subject factors and the percentile and skewness as within-subject factors. One hundred and seventeen subjects took part in a computerized experiment, each subject receiving a diskette containing the experiment, the instructions, the case material, and the questionnaire. The subjects completed the experiment in their own time, sitting at a microcomputer directly interacting with the system through the keyboard; their responses were automatically recorded on the diskette.

The subjects' responses were analyzed with a split-plot ANOVA. Four variables were studied in this experiment; two (format and scaling) were of primary interest and were treated as between-subject variables in the ANOVA design, and two other variables (skewness and percentile) were treated as within-subject variables in the experimental design.

Conclusions

Since investors' and creditors' cash flows are related to enterprise cash flows, financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise. This objective distinguishes between cash flows to investors and creditors and cash to a given enterprise to which they have committed funds. Naturally, a given investor or creditor wants to know his personal chances of receiving cash from dividends, interest or other sources. However, his personal chances depend on the expected cash flows to the enterprise. If the enterprise is successful in generating

favorable cash flows, the probability of investors' and creditors' receiving favorable cash flows is enhanced. In the FASB-issued Objectives of Financial Reporting by Business Enterprises (SFAC No. 1), it states [1978, par. 37]:

financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise.

SFAC No. 1 also goes on to state that:

"financial reporting should provide information to help present and potential investors and creditors and other users in assessing the amounts, timing and uncertainty of prospective cash receipts from dividends or interest and the proceeds from the sale, redemption, or maturity of securities or loans."

Rational investment, credit, and similar decisions are made after careful consideration of factors such as expected cost, risk, and return. Thus, an investor or creditor who commits cash to a business would like to know if, when, and how much cash will be returned. Information that helps to resolve these uncertainties would surely be regarded as useful. This research has not tried to provide an accounting information model to definitively answer the issues associated with the *amount, timing and uncertainty of prospective net cash inflows*; rather, it has tried to make an initial effort to examine what can be done in terms of format and scaling characteristics of financial statement data to influence positively the decisionmaking about prospective net cash inflows. To that end, this research was successful in providing evidence that when there is uncertainty in the financial statement data and supplemental information is available, the decisionmaker will avail himself of that information when estimating the prospective net cash inflows from operations. Hypothesis 1 was supported by the data captured in the experiment. The subjects associated a higher estimate to net cash flow from operations when they were presented with probabilistic, graphical and left skewed supplemental data to clarify the collection of cash from accounts receivable. Using the

supplemental information is consistent with Libby's [1979] findings that the decisionmaker is motivated to use the additional information to estimate the outcome of the uncertainty. In this case, the additional information was graphical and probabilistic financial data about the uncertainty of collecting the balance of accounts receivable. The results of this research indicate support for both the ASOBAT and Trueblood statements that decisionmakers need supplemental information to reduce reporting uncertainty. The conceptual framework should be the stimulus for research, and the incentive and opportunity for changing the format and scaling of financial statement data are provided by SFAC No. 1.

Recommendations

The results of this experiment cannot be generalized to subjects of other focal populations and to other environmental conditions. This being so, with what other subjects and under what other environmental conditions can the same results be expected?

This experiment represents an initial investigation into format and scaling characteristics of financial statement data; thus, the results appear to have important implications for future research. The research findings suggest that the practical applications of scaling and format characteristics have a positive impact on decisionmaking about prospective net cash inflows. This research needs to be extended in three different directions: (1) the variables studied, (2) the industries represented in the financial statements and consequently the financial variables for supplemental graphical and probabilistic financial data, and (3) the focal population from which to sample subjects.

Variables Of Interest

Other dependent variables (e.g. premium over prime, amount of loan, etc.) need to be studied in the context of this experimental task. To study these variables will require minor changes in the experimental instrument.

Consistency

Consistency refers to judgment stability over time. At least two kinds of research questions are apparent: (1) research concerning *extent* of inconsistency and (2) research concerning *effects* of inconsistency. The former would observe consistency over time, and the latter would observe the consequences of the estimates in relation to investors' and creditors' subsequent actions.

Response Time

Time as a variable of interest may be a dependent variable, or it may be an independent variable and manipulated. As a dependent variable, time may be measured as a matter of response time to make an estimate of cash flows, whereas time as an independent variable may be manipulated to induce various levels of time pressure on the decisionmaker.

Cue Usage

The Brunswick [1952] lens model provides a general structure to highlight many important characteristics of decisionmaking under uncertainty. The model will portray the individual's making estimates of cash flow through a lens of cues whose relationship to both the actual subsequent cash flow and the decisionmaker is uncertain. The interaction between the decisionmaker and the environment is described by a number of relationships, including those among the cues and the decisionmaker's estimate of cash

flow, those between the cues and the decisionmaker's estimate, and those between the actual subsequent cash flow and the decisionmaker's estimate. The cue usage may vary depending on the external pressure to make a decision.

Dependent Variable

In this experiment each subject was given the task of estimating cash flow. The subjects' responses were analyzed to determine if there was any significant difference as a result of manipulating the format and scaling characteristics of financial statement data. Other possible dependent variables would be subject to the focal population to be sampled. For example, if bank loan officers are to be sampled, then the task may request an estimate of the premium over prime and the amount of the approved line of credit. The task can be varied depending on the focal population.

Detailing The Supplemental Information

To facilitate the task of providing graphical and probabilistic supplemental information, a physicians' office was chosen because the most significant variable was accounts receivable. Other financial variables need to be selected for providing supplemental information, but this will be dependent on the enterprise described in the experiment.

Enterprises Studied

The experiment needs to be replicated in terms of the industries studied. For reasons of convenience, this research studied a very simplistic set of financial statements for a physicians' office. The research needs to be replicated for retailing, manufacturing, wholesaling, contractors, other service industries, and finance enterprises. These other enterprises will necessitate considering and studying other financial statement variables. This research merely supplemented the accounts receivable balance

with graphical and probabilistic financial data. As the enterprises considered for research are expanded, decisions will need to be made about the most appropriate variable or combination of variables to be supplemented with graphical and probabilistic financial data.

Focal Population

Various investors and creditors use financial statements to make decisions either directly about cash flow or indirectly about cash flow, decisions such as interest rate premiums and amounts of loans, range of credit to be extended, etc. Other subjects who make decisions using financial statement data are stockbrokers and bank loan officers. Identification of these decisionmaking groups and replication of the experiment will greatly contribute to the external validity of the results. The current sample of subjects were taken from a subset of the population which is not only responsible for the presentation of financial statements but is also a major user in consultation with its clients. Replication of the experiment with other focal populations will either confirm or disprove the current findings obtained. The replications will contribute to the representativeness or generalizability of the results.

Accounting System For Graphical And Probabilistic Information

Another area of research would include designing and describing an accounting model that could capture source transactions,³⁹ process the transactions into the ledger, maintain the required formatting and scaling characteristics by individual accounts, and then generate the financial statements with the additional formatting and scaling

³⁹. Any proposed model would probably not differ in terms of the current process, which is to record the transaction on source documents. The difference would be in the aggregation and filtering of the data.

characteristics. Having designed the system conceptually, one would next design the system in detail. The detailed design would then be followed by programming and procedure development of a prototype system to test a sample of transactions and generate a set of financial statements with the appropriate formatting and scaling characteristics described in the results of this experiment. This would represent a major step forward in the profession of accounting and would be a significant departure from what is currently being done when processing accounting data.

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Appendix A. Transmittal Letter

Cover letter
Subject comments

Paul M. Goldwater
111 Santa Rosa Dunes
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Pensacola Beach, Fl. 33661
(904) 932-5778

July 21, 1989

&Mr-Ms&. &full-name& &Jr-MD&
&title&
&company&
&addr1&
&addr2&
&city&
&state&, &zip&

Dear &Mr-Ms&. &full-name& &Jr-MD&:

We are conducting a computerized experiment in accounting. This experiment is concerned specifically with the format and scaling characteristics of financial information. The results of this study will help to provide insight in the future development of financial accounting standards.

We are particularly interested in the response of &company& senior personnel, because their experience will contribute significantly toward solving some of the problems we face in this important area in our profession. The experiment will involve case studies and a questionnaire contained on a computer diskette. The diskette has been tested with a sample of your colleagues, and we have revised it in order to make it possible for us to obtain all necessary data while requiring a minimum of your time. The average time required by your colleagues during the pilot test was 40 minutes (range 25 - 65 minutes).

The diskette will only function on an MS-DOS or compatible (e.g. PC-DOS) computer with a minimum 320KB of memory.

It will be appreciated if you will complete the task prior to January 31, 1989. We would welcome any comments that you may have concerning any aspect of the experiment. Although individual (and firm) responses are confidential we will be pleased to send you a summary of the research results.

Thank you for your cooperation. If you have any questions either before or after the experiment, or any difficulty in starting the computer program please call Mr. Goldwater at either of the following two numbers.

(904) 932-5778
(904) 474-0509

Sincerely yours,

Paul M. Goldwater
Research Coordinator

Anthony P. Curatola Ph.D.
Associate Professor of Accounting

**Additional Comments
(after experiment)**

**Information to Assess the Amounts, Timing, and Uncertainty
of Prospective Net Cash Inflows
(after experiment)**

Appendix B. Computerized Instrument

This is a complete screen dump of what subjects in group 2 were presented.

Welcome To The Experiment

Your task is to:

1. **Select and review information about four cases.**
2. **After each case estimate the prospective net cash inflow from operating activities for next year.**
3. **After the four cases answer some debriefing questions about the experiment in general.**

Press Any Key To Continue

This is the first screen flip presented to all subjects. Depending on the group to which the subject is allocated, the number of cases will either be indicated as four (as above) or as two.

Instructions

1. The experiment is menu driven - you make your selection from menus and the system will respond accordingly. You need to be familiar with the [PgDn], [PgUp], [Esc] and [Enter] keys.
2. During each case you will be able to request a previous item of information as many times as you wish.
3. You need to remember that after each case you will be asked to respond to the following statement:
 - * Estimate the prospective net cash inflow from operating
 - * activities for next year.

Press Any Key To Continue

All subjects received this screen flip. It reminds the subject of the keyboard usage and the task to be completed.

Tutorial On Decisionmaking Under Risk

Business decisions are seldom made assuming the availability of perfect information. For example, when predicting cash flow, the variables of interest are uncertain. Although the results of many business decisions are not predictable with certainty, they may nevertheless be predicted with some degree of confidence. This confidence may be represented by a probability statement. This statement may be either a table of values (e.g. mean, variance, etc.) or a graphical distribution. By examining either the table or graph, one can determine the probability of specific amounts occurring. The next two screens will present two examples of how to read probabilistic information and what it means. Both of these examples indicate at a glance the most likely outcome for the event. A decisionmaker should base one's decision on the shape of the distribution and one's own attitude towards risk.

Press Any Key To Continue

Only subjects in groups 2 and 5 received this screen flip and the screen flips on the next three pages.

For example in this graph and related table there is a greater chance that the cash flow will be \$990 than it will be \$3,390.

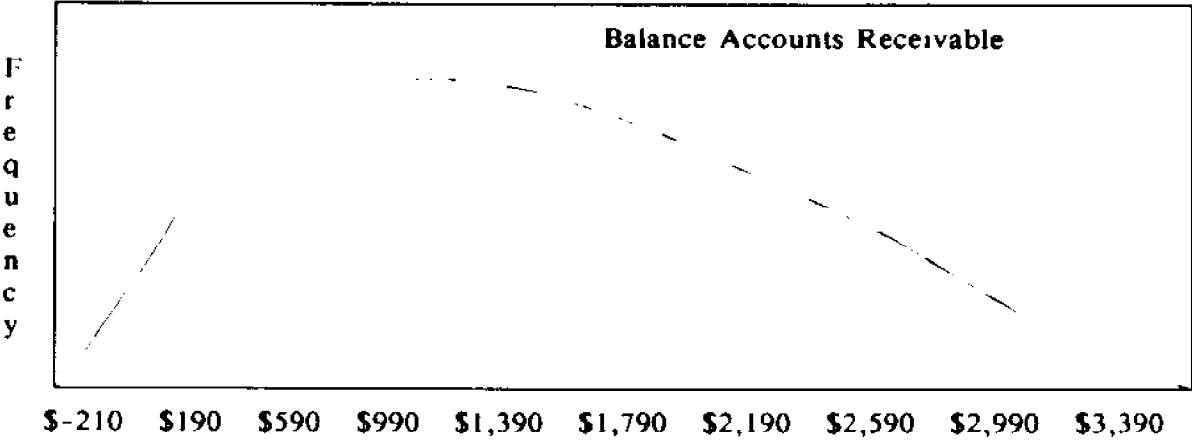


Table:
Balance Accounts
Receivable

Mode:	\$590
Mean:	\$1,590
Standard Deviation:	\$1,149
Range:	\$(210) to \$3,390

Press Any Key To Continue

The next distribution is bunched in the opposite direction. The most likely amount to occur is \$5,590.

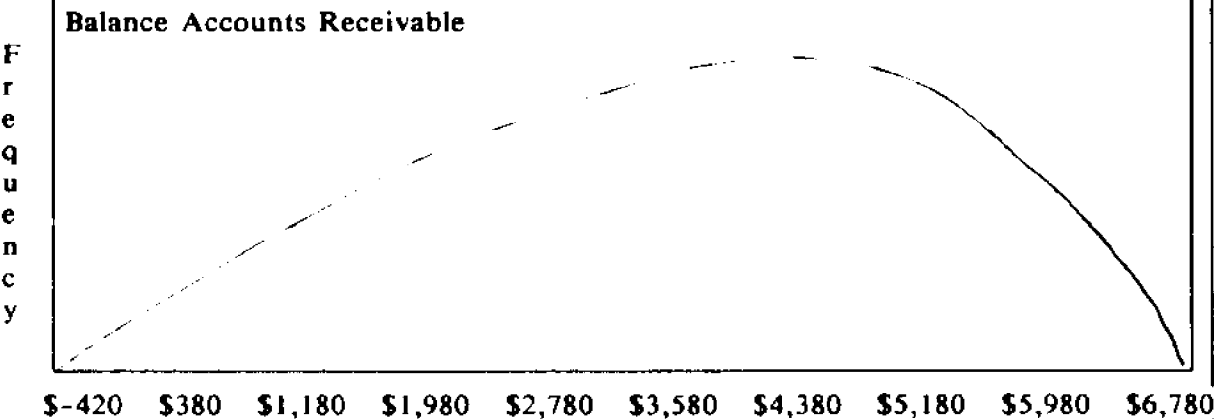
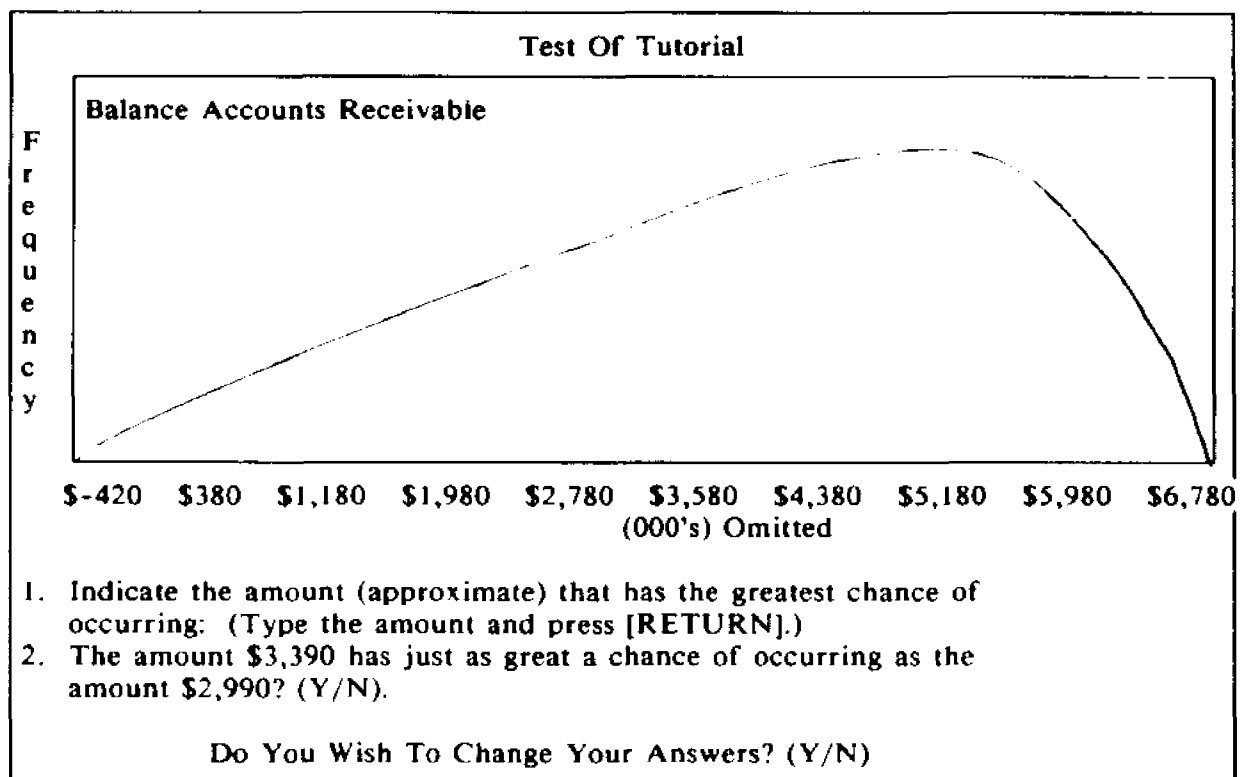


Table:
Balance Accounts
Receivable

Mode:	\$590
Mean:	\$5,580
Standard Deviation:	\$3,180
Range:	\$(420) to \$6,780

Press Any Key To Continue



UNCHANGING BACKGROUND INFORMATION

The Medical Center Clinic, P.A. is a physician owned, group medical practice comprised of 140 specialty physicians and several hundred specialty trained health care professionals. The Clinic is contained in a 11 story, state-of-the-art main facility, next to a 500 bed for-profit hospital. The clinic also has family medical centers located in neighboring communities. The Clinic started 50 years ago.

The executive committee has been concerned about rising medical costs and decreased medicare payments as a result of DRG's. Because of a depressed local economy the collectability of the accounts receivable is of some concern. The market share of patients has been decreasing from competition with independent physicians in the community who are not connected with the Clinic.

The Clinic has received an **unqualified audit opinion**, but an **uncertainty** was noted concerning the collectability of accounts receivable.

Press Any Key To Continue

All subjects received this screen flip, presenting a general discussion of the organization, the economic environment, diagnostic related groups and the health maintenance organization.

The Menu Of Information Choices For The Cases Will Now Be Presented

Remember you need to review the information about the case to respond to the following statement:

- * Estimate the prospective net cash inflow from operating
- * activities for next year.

Before responding to this statement, remember you will be able to request items of information about the case from a menu of choices and you can estimate the prospective net cash inflow whenever you are ready.

Press Any Key To Continue

All subjects received this screen flip as a final warning of the task expected of the subject.

MENU

Please use as many of the following information items you consider necessary to estimate the net cash inflow from operation for next year. You may make the selection as many times as you need.

Case 1 of 2

1. Statement of Cash Flows
2. Statement of Financial Position (Balance Sheet)
3. Robert Morris Associates Financial Ratios
4. Five Year Summary
5. Audit Report
6. Redo Tutorial on Uncertainty
7. Credit Report
8. Background Information
9. Summary Statistics on Accounts Receivable
10. Notes to Financial Statements
11. Statement of Earnings (Income Statement)
12. I am now ready to estimate the net cash flow from operations for next year.

Enter Your Selection:
and press [Enter]

The available cues in this menu were determined by the treatment group to which the subject was randomly allocated. This specific screen flip represents group 2.

WARNING

Have you made your estimate of the net cash inflow from operations for next year? The next screen will require you to enter your estimate.

Y = you will enter your estimate on the next screen.

N = you will return to the MENU

(Y/N)? ☐

All subjects received this screen flip. This cautions the subject to consider the next action. If the subject has decided on the estimate of cash flow for next year, then enter "Y" and the next screen will request the amount. If the subject has not arrived at an estimate, then enter "N" and return to the menu of cues and continue to make judgments about cash flow.

ESTIMATE OF NET CASH INFLOW FROM OPERATIONS

What is your best estimate of the operating
net cash inflow for next year?

Enter the amount in thousands and press ENTER

\$,000

Do You Wish To Change Your Estimate? (Y/N) ☐

All subjects received this screen flip. The statistical analysis was based on subjects' responses to this screen after their evaluation of the information cues for each case.

DEBRIEFING QUESTIONNAIRE

1. I am aware of the Financial Accounting Standards Board conceptual framework. ☐
2. I am familiar with SFAC No. 1. ☐
3. I am familiar with SFAC No. 2. ☐
4. Would you have found additional information concerning the fictitious ☐
5. Did you feel comfortable making an estimate of the net cash inflow from operations given the limited data in the cases? ☐
6. Compared to your professional colleagues, how would you describe your willingness to take risks? ☐
1 = much less willing, 2 = about average, 3 = much more willing
7. Please allocate 100 points to the traditional accounting and non-traditional accounting information on the basis of your reliance on them in completing this task. Traditional: Non-traditional:

All subjects received this screen flip. These are the debriefing questions.

8. How interesting did you find this experiment? ☐
1 = very dull, 2 = dull, 3 = interesting, 4 = very interesting
9. How many years of working experience do you have? (Nearest year) ☐
10. Highest level of education attained? ☐
1 = undergraduate, 2 = masters, 3 = Ph.D., 4 = other
11. How old are you? (To the nearest year) ☐
12. I found the instructions very clear. (Y/N) ☐
13. While doing the experiment, did you jot or write down any
information to help you arrive at your decisions? (Y/N) ☐
14. How many minutes do you think it took to complete this experiment? ☐
15. If you have any comments about the experiment or the experimental
materials, please indicate them on the enclosed sheet.
16. Please indicate on the enclosed sheet any method you currently
use to assess the uncertainty of prospective net cash inflows.

Do you wish to change your answers? (Y/N) ☐

All subjects received this second screen of debriefing questions, and all subjects' responses were edited for field acceptability. For example, question 1 would accept only a "Y" or "N" response; if any other response were given the subject could not continue. Question 7 required the two amounts to add to 100%; otherwise, the subject could not continue to question 8. This process ensured that all subjects' responses produced valid data for subsequent analysis.

Results Of The Experiment	
Would you like to receive a summary of the results of all subjects responses to this experiment? (Y/N)	<input type="checkbox"/>
Name:	
Firm:	
Address line 1:	
Address line 2:	
City:	
State:	
Zip:	
Do you wish to make any changes? (Y/N)	

All subjects receive this screen flip. Those subjects who provided their name and address were automatically sent a summary of the results showing their own responses in relationship to group means.

Thank You For Taking Part

We appreciate your time and effort in providing us with the data for this experiment.

Remove the diskette and return it to the partner in charge.

Turn off the computer, and again, thank you.

Sincerely,
Paul M. Goldwater
Department of Accounting
Louisiana State University
Phone: (904) 474-0509 or (904) 932-5778

All subjects received this screen flip. The subjects' responses have been saved on the diskette to be returned to the researcher for processing.

Appendix C. Examination And Analysis Of Subject Data

Case 1

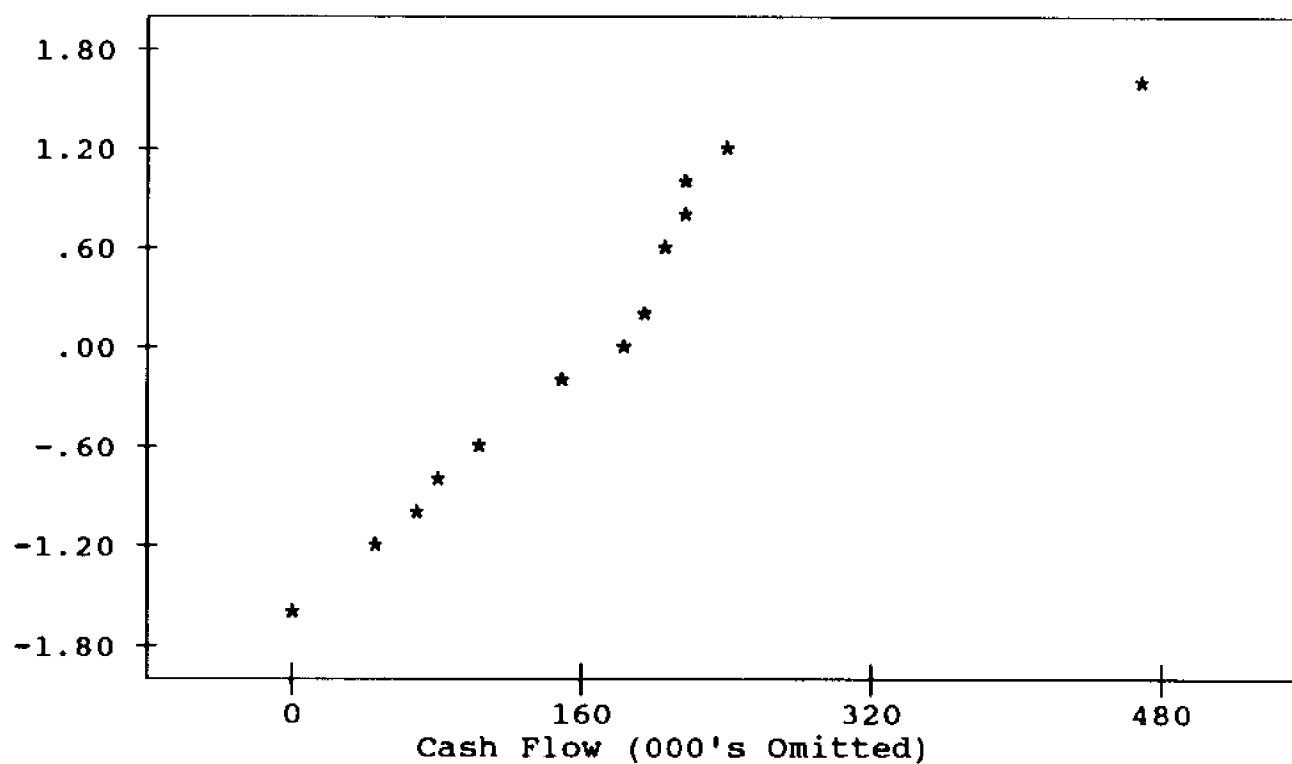
Valid cases: 16

Frequency	Stem &	Leaf
1.00	0 *	0
3.00	0 .	578
1.00	1 *	0
4.00	1 .	5558
6.00	2 *	001224
1.00	Extremes	(477)

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.8893	16	.0561
K-S (Lilliefors)	.1822	16	.1615

Case 2

Valid cases: 16

Frequency Stem & Leaf

```

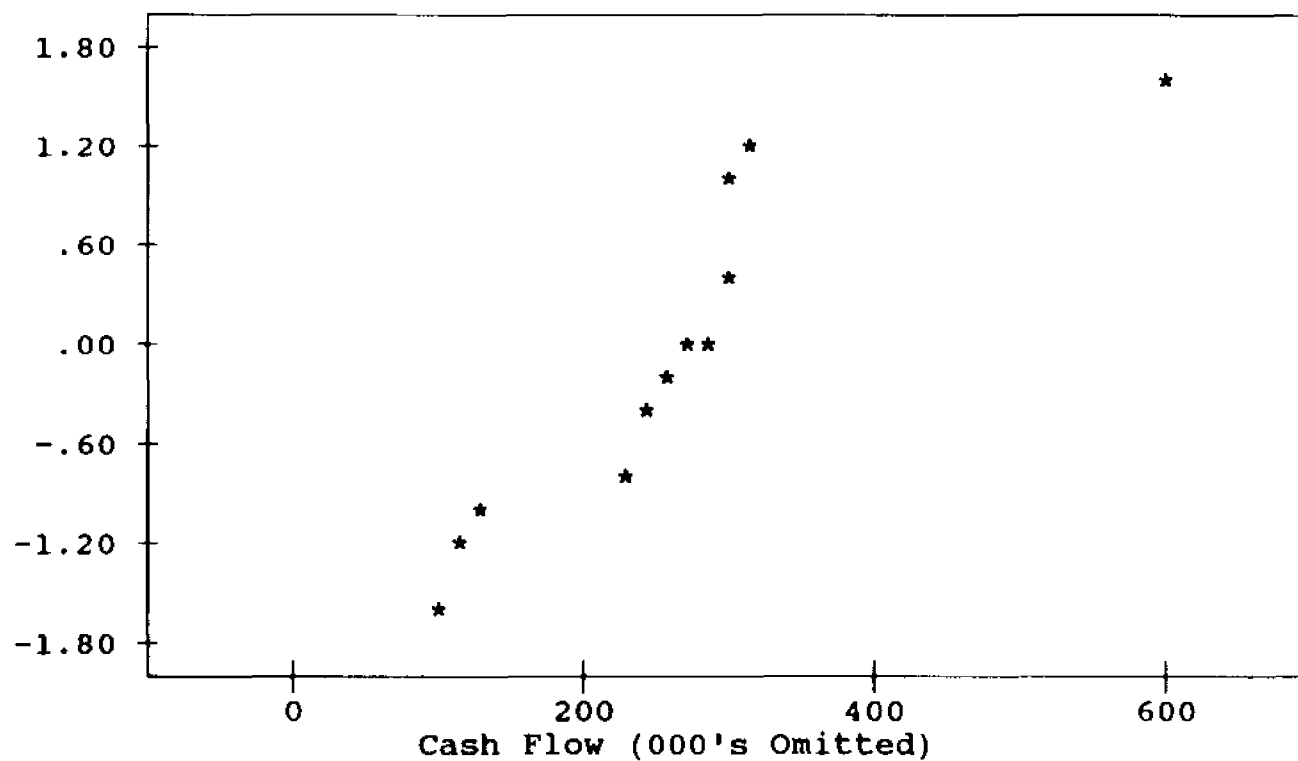
3.00 Extremes (108), (125), (134)
3.00      2 * 444
3.00      2 . 689
6.00      3 * 000012
1.00 Extremes (600)

```

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.8054	16	< .0100
K-S (Lilliefors)	.2568	16	.0059

Case 3

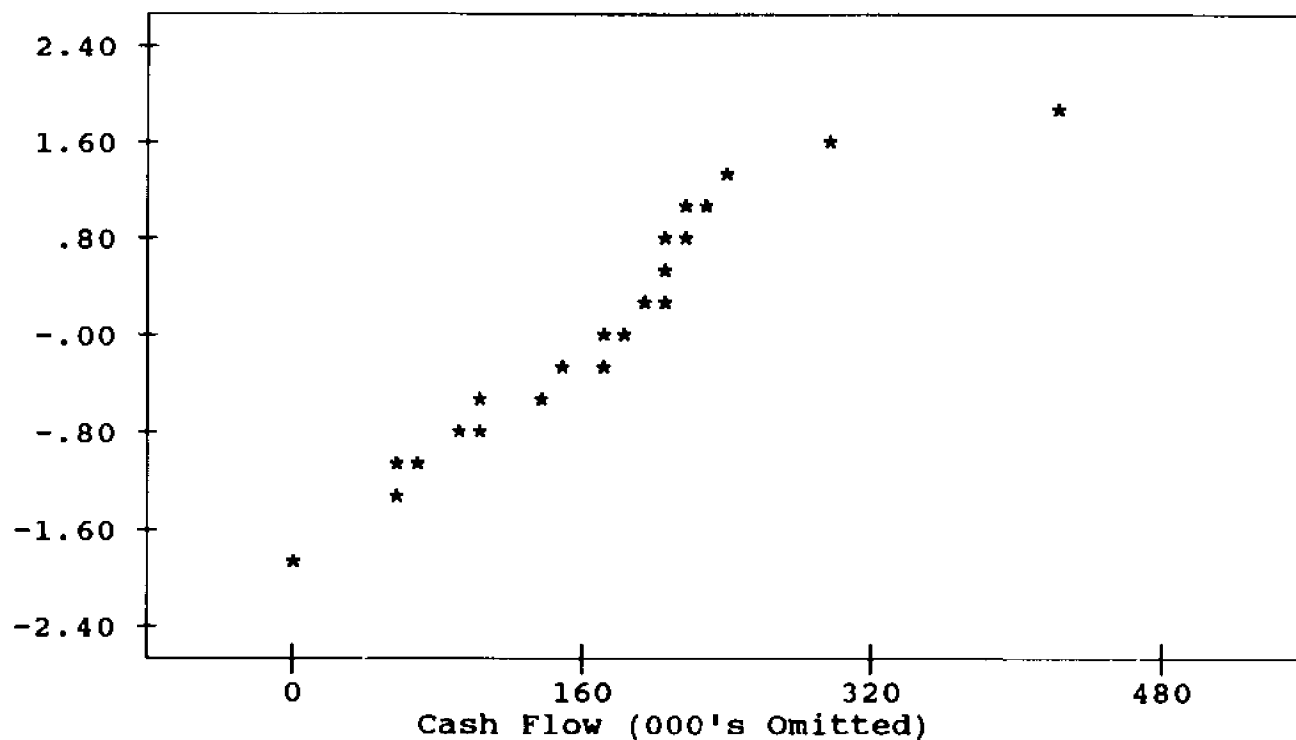
Valid cases: 28

Frequency	Stem &	Leaf
1.00	0 *	0
4.00	0 .	6667
4.00	1 *	0114
6.00	1 .	577888
10.00	2 *	0011111223
1.00	2 .	5
1.00	3 *	0
1.00	Extremes (433)	

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9345	28	.0938
K-S (Lilliefors)	.1522	28	.0956

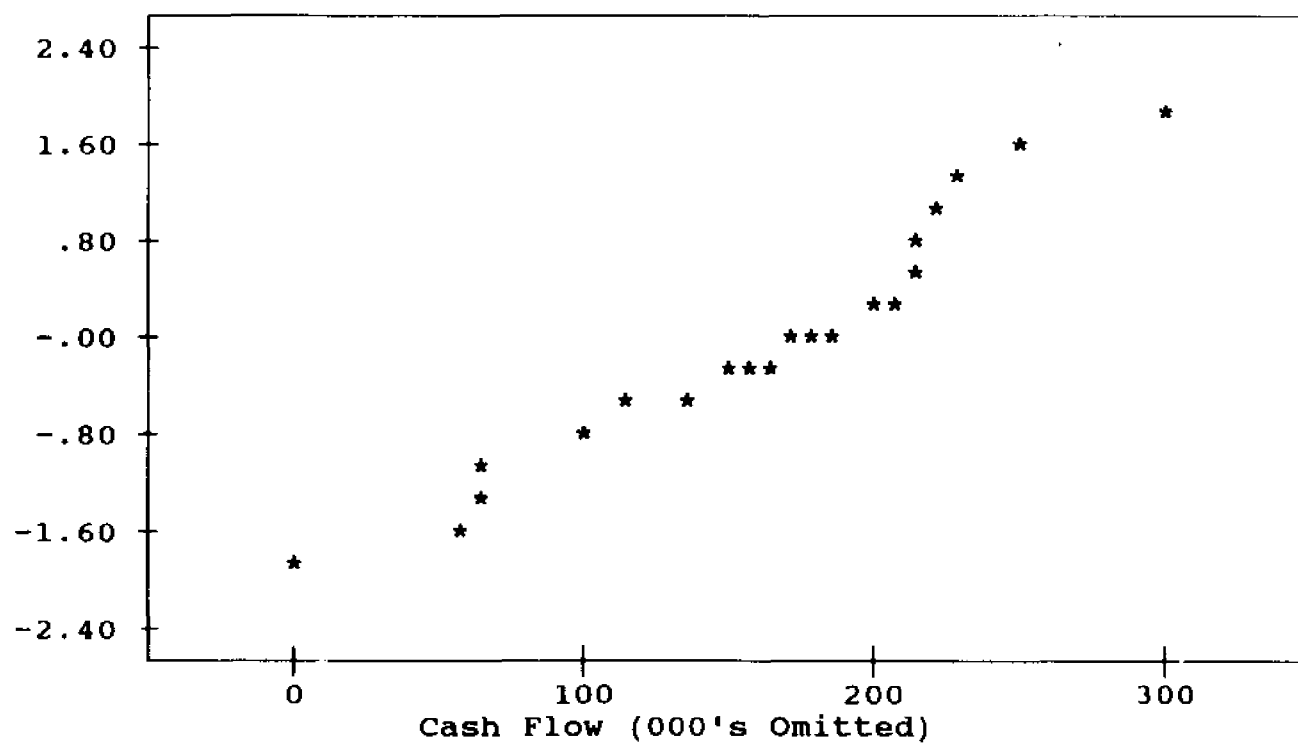
Case 4

Valid cases: 28

Frequency	Stem	&	Leaf
1.00	0	*	0
3.00	0	.	666
5.00	1	*	00014
6.00	1	.	556788
11.00	2	*	00111122223
1.00	2	.	5
1.00	3	*	0

Stem width: 100
Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9456	28	.2274
K-S (Lilliefors)	.1103	28	> .2000

Case 5

Valid cases: 28

Frequency Stem & Leaf

```

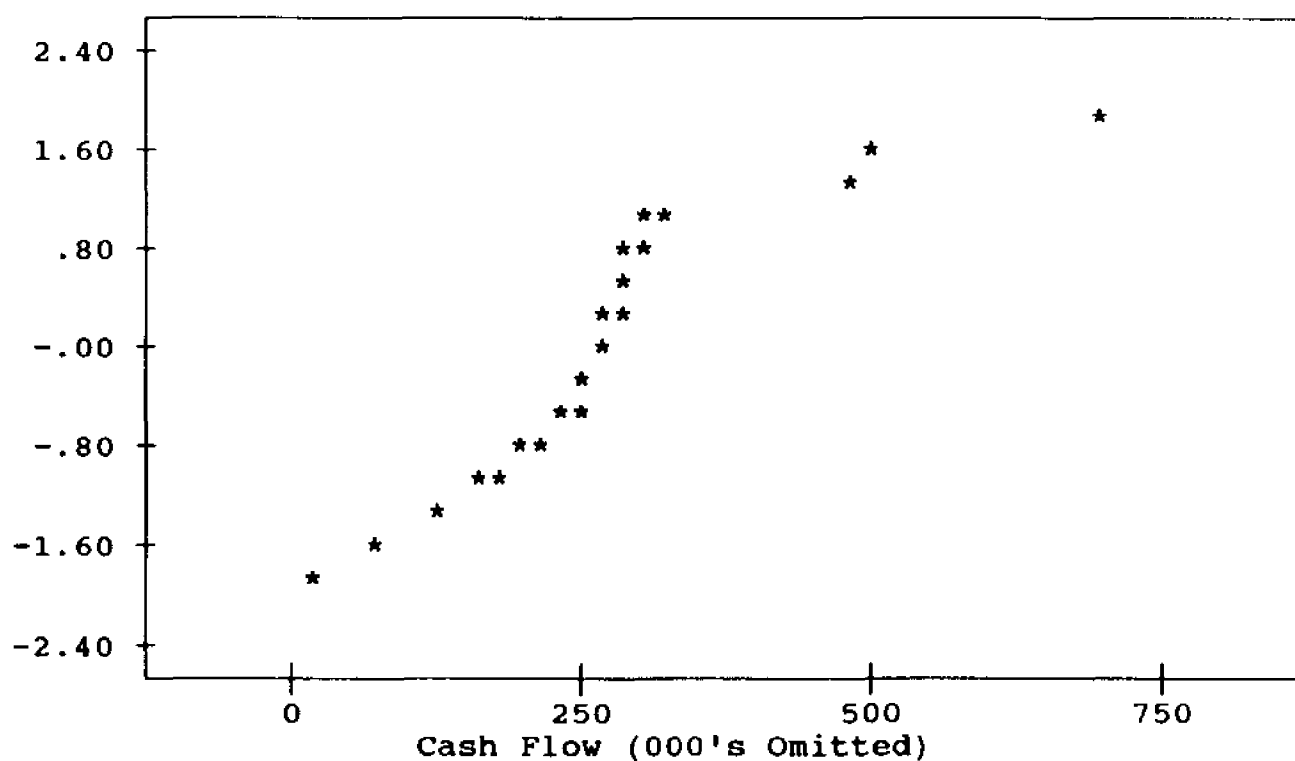
    2.00 Extremes      (33), (85)
    1.00      1 * 4
    2.00      1 . 79
    3.00      2 * 124
   10.00      2 . 5566777789
    7.00      3 * 0000023
    3.00 Extremes      (485), (500), (710)

```

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.8482	28	< .0100
K-S (Lilliefors)	.2450	28	.0002

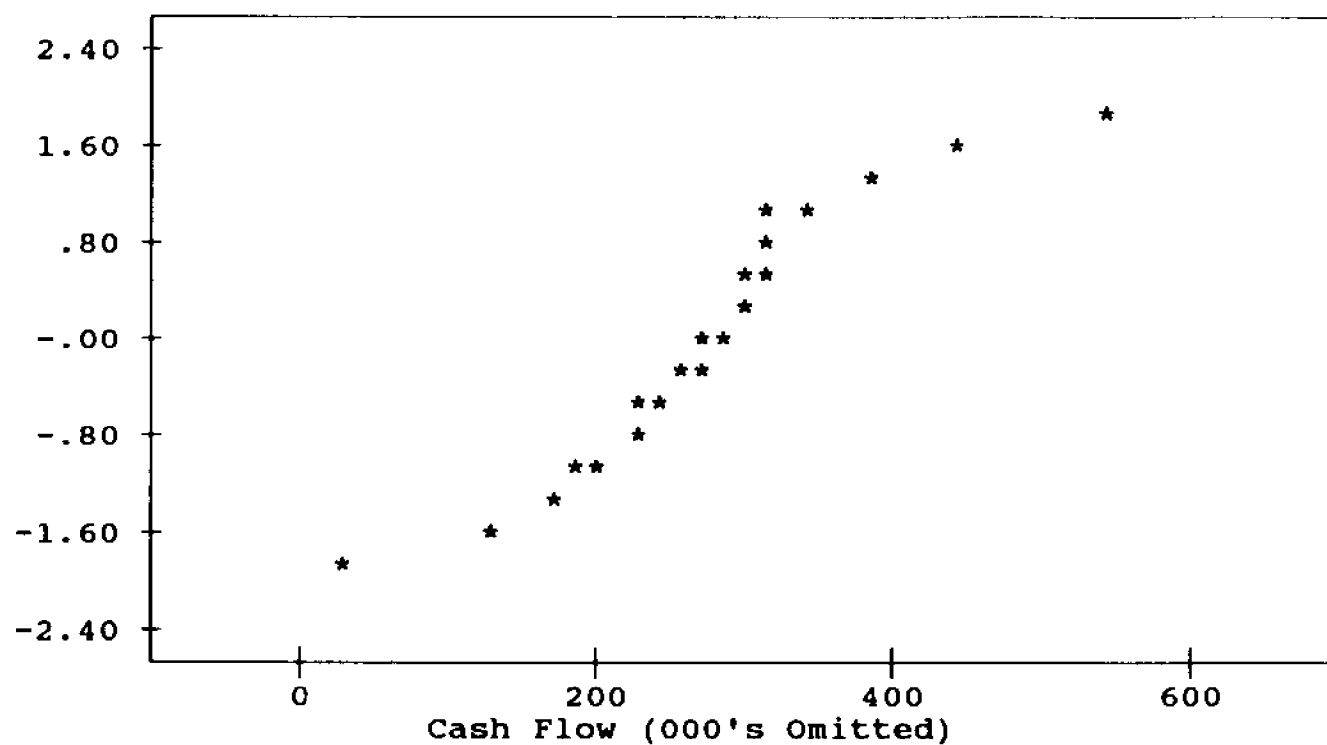
Case 6

Valid cases: 28

Frequency	Stem &	Leaf
1.00	Extremes	(34)
1.00	1 *	4
2.00	1 .	79
4.00	2 *	1334
8.00	2 .	55777899
9.00	3 *	000012224
1.00	3 .	9
2.00	Extremes	(450), (545)

Stem width: 100
Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9373	28	.1175
K-S (Lilliefors)	.1704	28	.0364

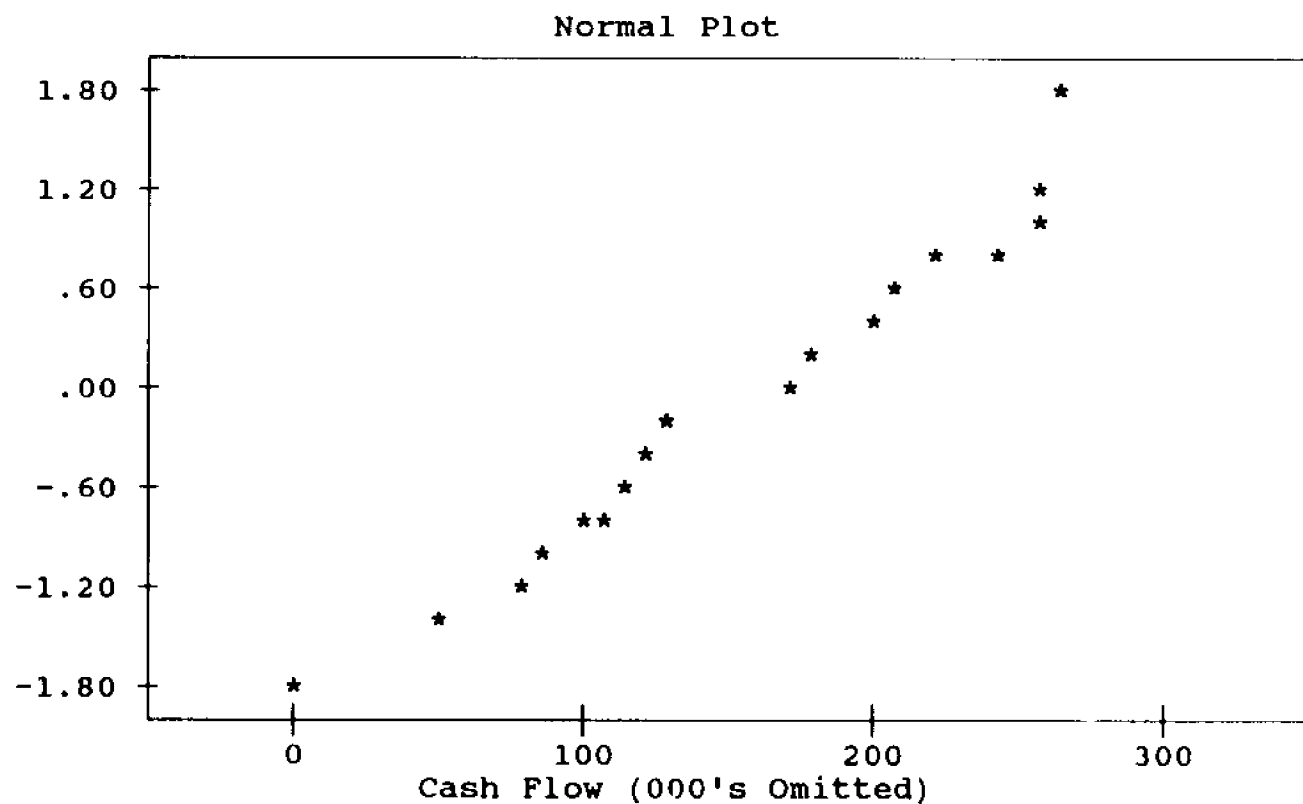
Case 7

Valid cases: 24

Frequency	Stem	&	Leaf
1.00	0	*	0
3.00	0	.	589
7.00	1	*	0122233
3.00	1	.	788
6.00	2	*	000124
4.00	2	.	6667

Stem width: 100

Each leaf: 1 case(s)



	Statistic	df	Significance
Shapiro-Wilks	.9552	24	.4049
K-S (Lilliefors)	.1402	24	> .2000

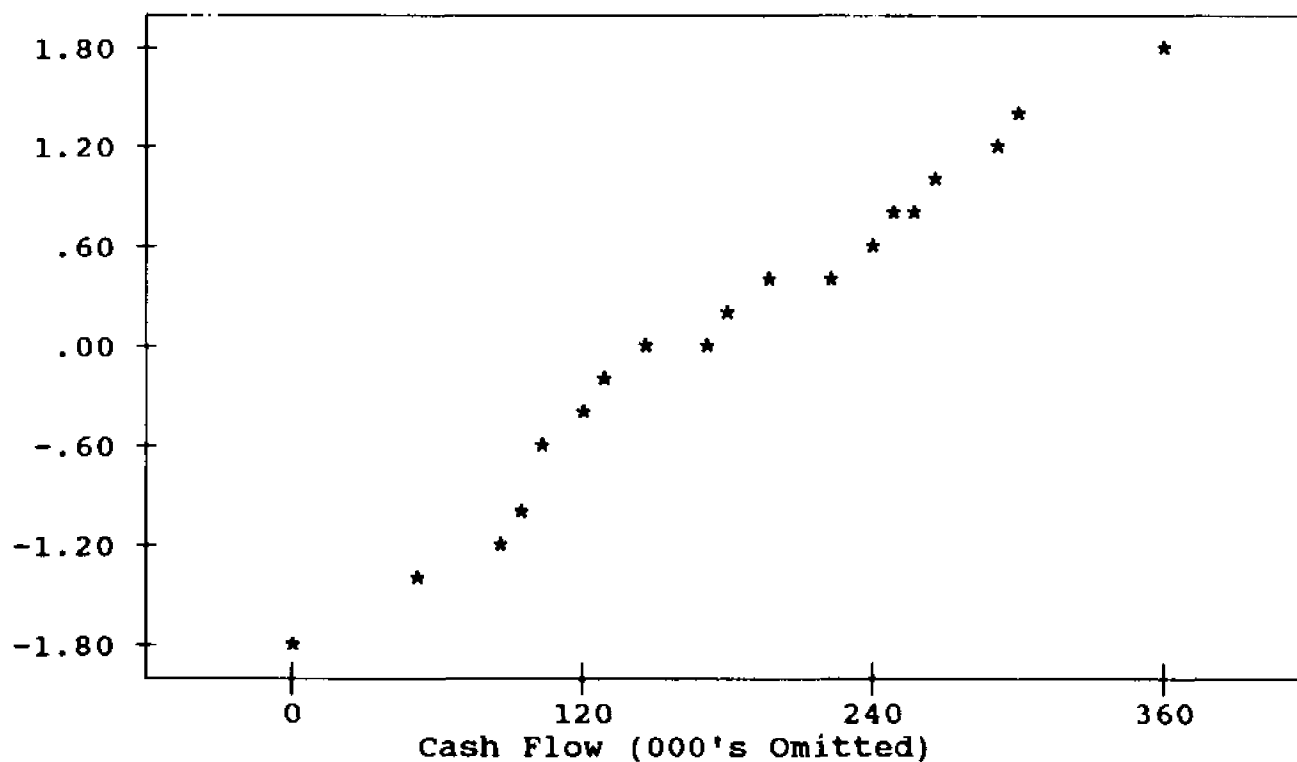
Case 8

Valid cases: 24

Frequency	Stem	&	Leaf
1.00	0	*	0
2.00	0	.	59
8.00	1	*	00112233
4.00	1	.	5788
3.00	2	*	024
4.00	2	.	5679
1.00	3	*	0
1.00	3	.	6

Stem width: 100
 Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9722	24	.7039
K-S (Lilliefors)	.1498	24	.1740

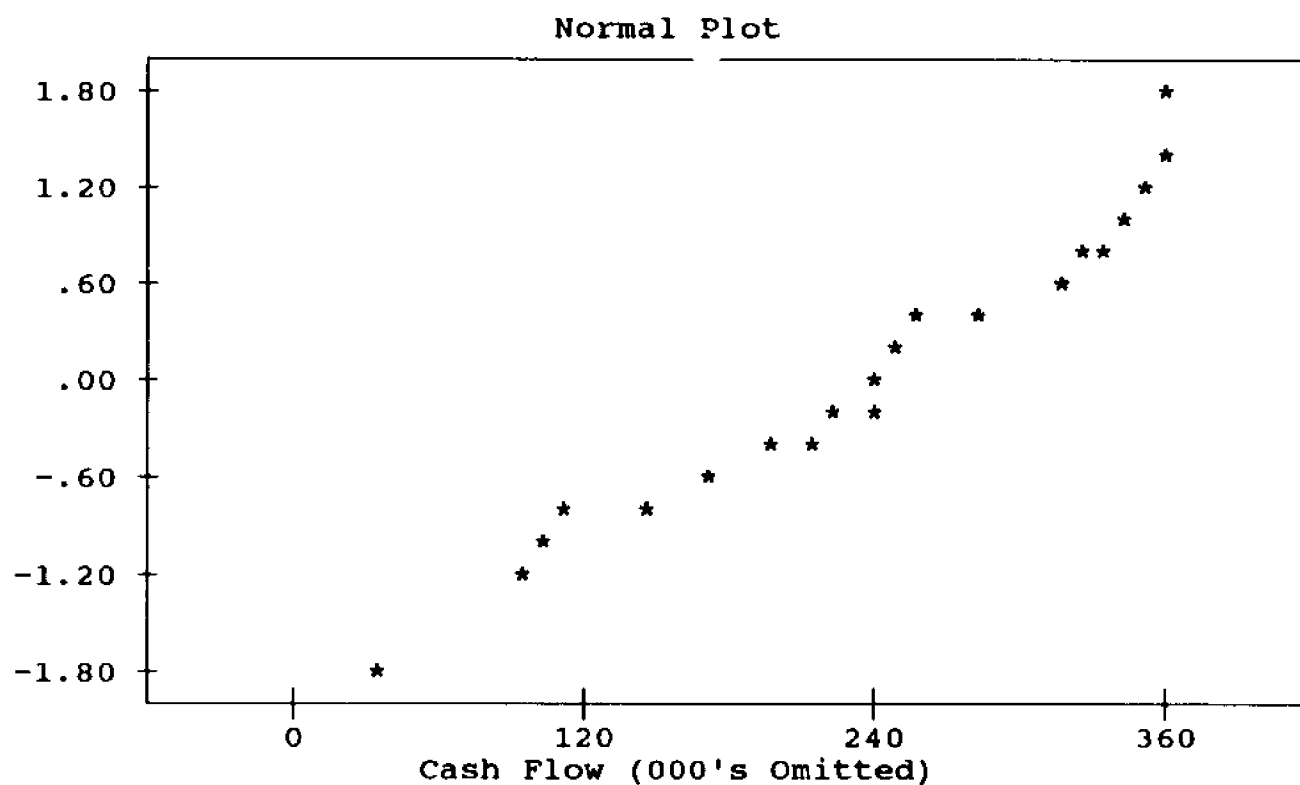
Case 9

Valid cases: 24

Frequency	Stem	&	Leaf
1.00	0	*	3
.00	0	.	
4.00	1	*	0012
2.00	1	.	57
5.00	2	*	01244
5.00	2	.	55569
3.00	3	*	234
4.00	3	.	5666

Stem width: 100

Each leaf: 1 case(s)



	Statistic	df	Significance
Shapiro-Wilks	.9374	24	.1901
K-S (Lilliefors)	.0949	24	> .2000

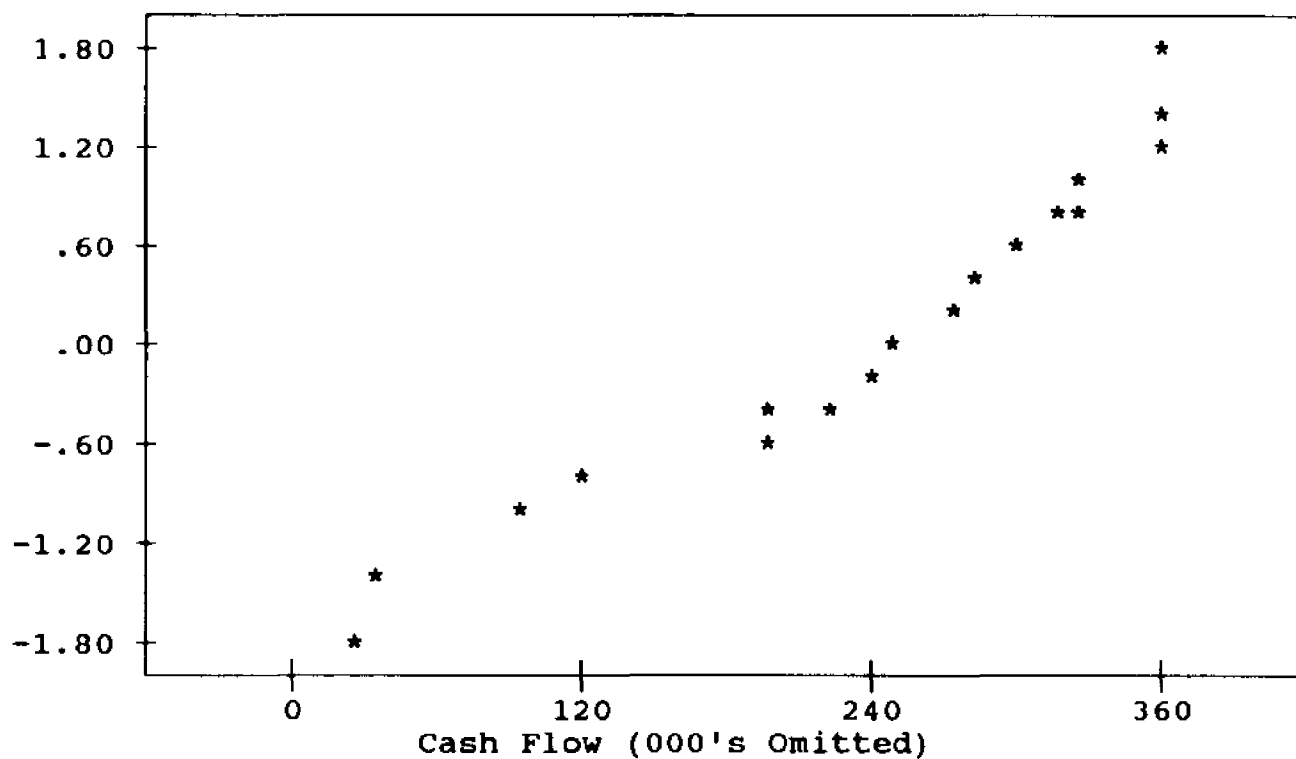
Case 10

Valid cases: 24

Frequency	Stem	&	Leaf
2.00	0	*	33
.00	0	.	
4.00	1	*	0002
.00	1	.	
5.00	2	*	00224
5.00	2	.	55789
5.00	3	*	00233
3.00	3	.	666

Stem width: 100
 Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9120	24	.0433
K-S (Lilliefors)	.1163	24	> .2000

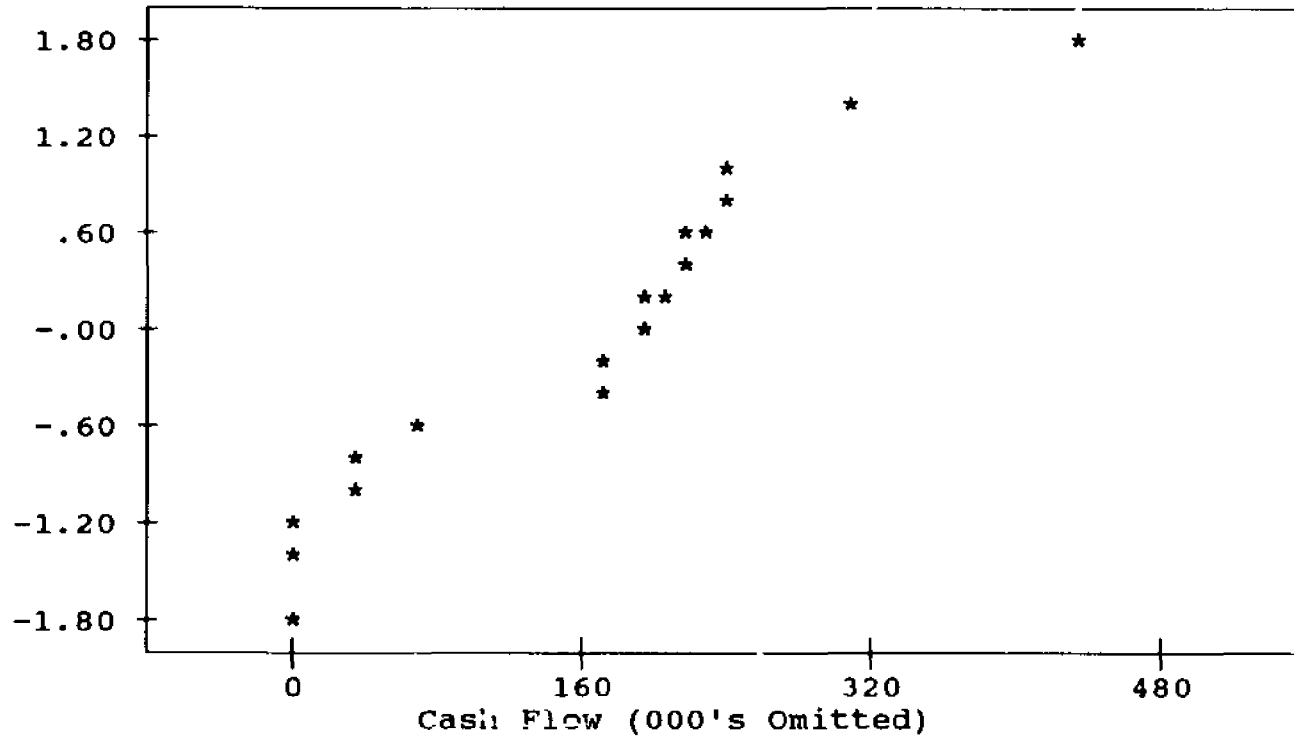
Case 11

Valid cases: 22

Frequency	Stem &	Leaf
6.00	0 .	001447
4.00	1 .	7778
10.00	2 .	0001223455
1.00	3 .	1
1.00	4 .	4

Stem width: 100
 Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9108	22	.0497
K-S (Lilliefors)	.1584	22	.1587

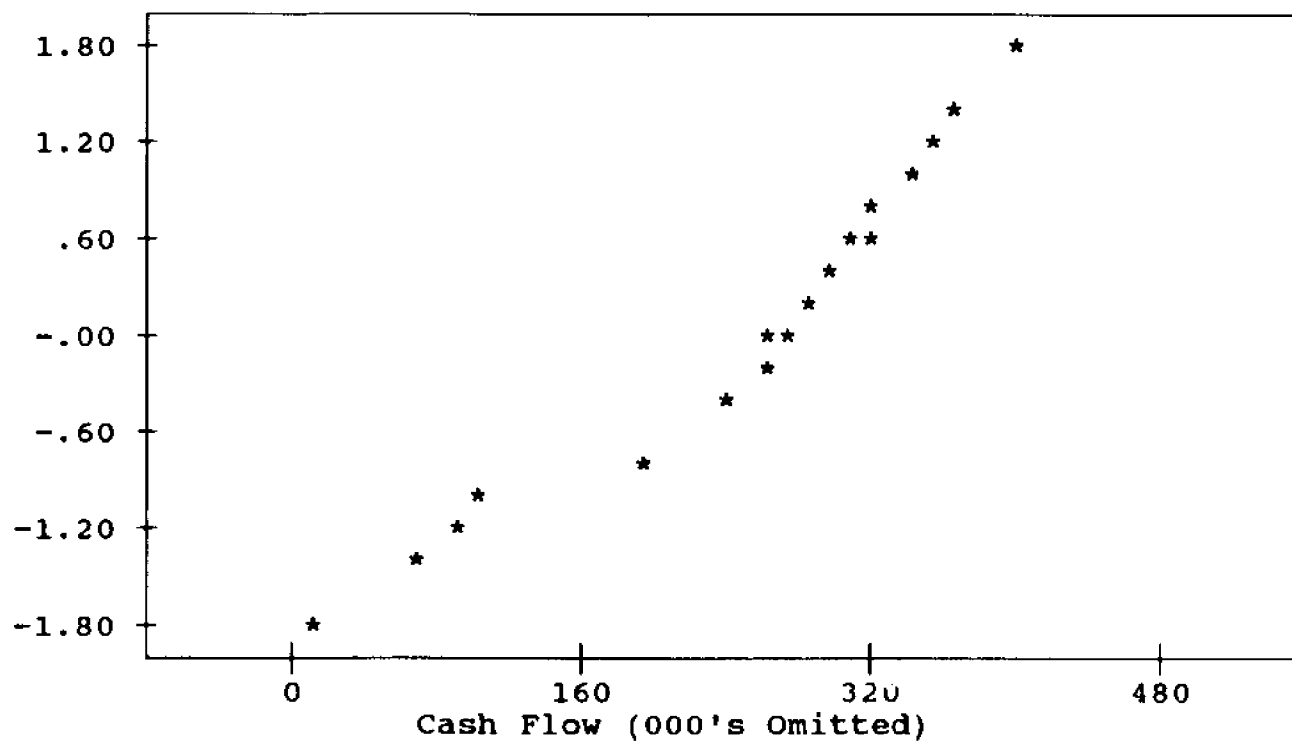
Case 12

Valid cases: 22

Frequency	Stem &	Leaf
2.00	0 .	27
2.00	1 .	01
10.00	2 .	0055566889
7.00	3 .	0122556
1.00	4 .	0

Stem width: 100
Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9177	22	.0724
K-S (Lilliefors)	.1060	22	> .2000

Case 13

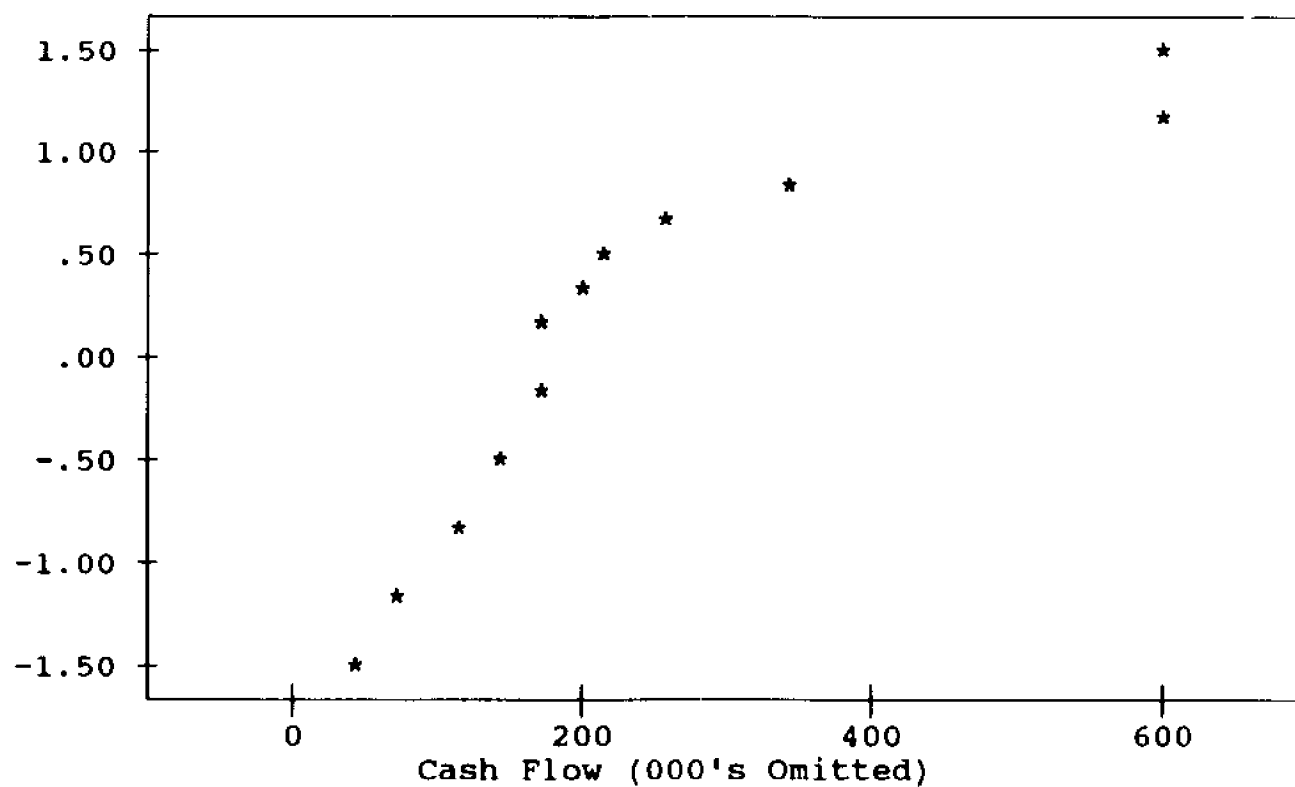
Valid cases: 14

Frequency	Stem &	Leaf
2.00	0 .	58
6.00	1 .	255578
3.00	2 .	027
1.00	3 .	5
2.00	Extremes (600), (612)	

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.7968	14	< .0100
K-S (Lilliefors)	.2519	14	.0163

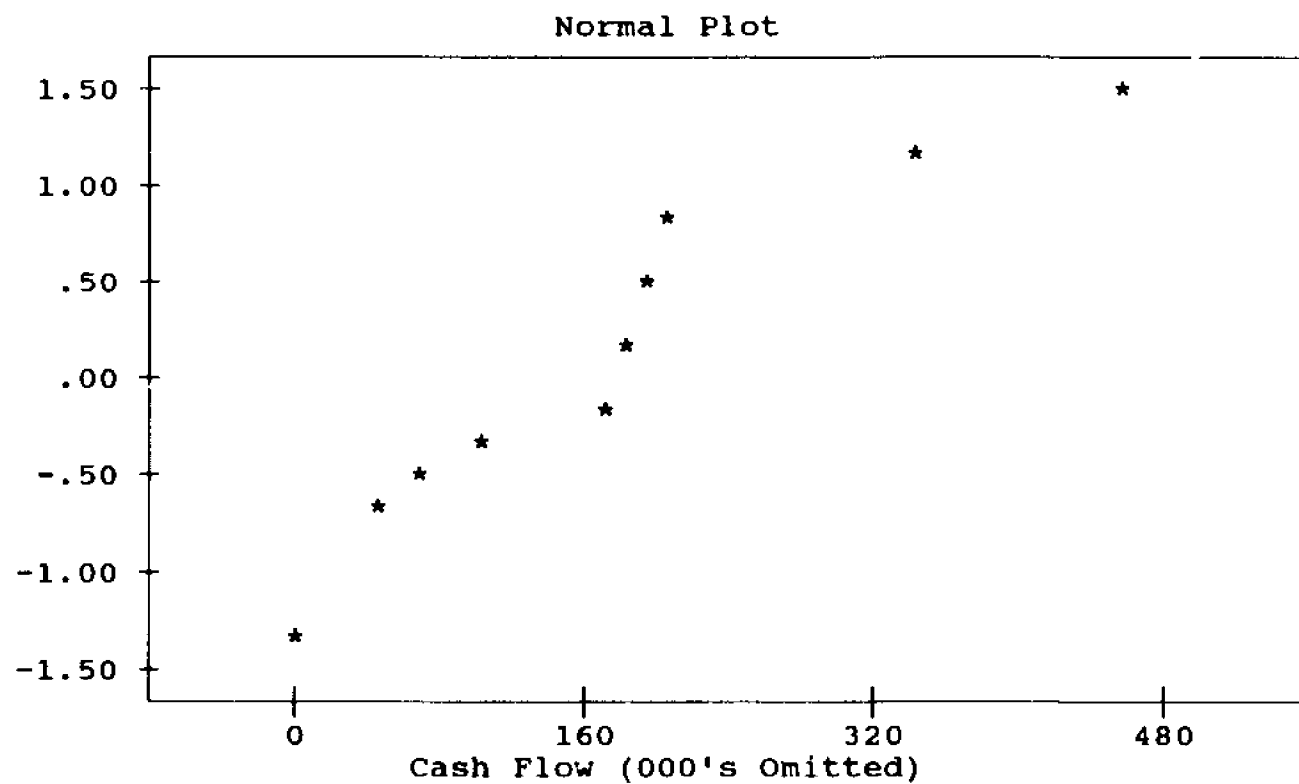
Case 14

Valid cases: 14

Frequency	Stem &	Leaf
5.00	0 .	11557
3.00	1 .	179
4.00	2 .	0001
1.00	3 .	5
1.00	Extremes	(461)

Stem width: 100

Each leaf: 1 case(s)



	Statistic	df	Significance
Shapiro-Wilks	.8986	14	.1276
K-S (Lilliefors)	.2160	14	.0756

Case 15

Valid cases: 14

Frequency Stem & Leaf

```

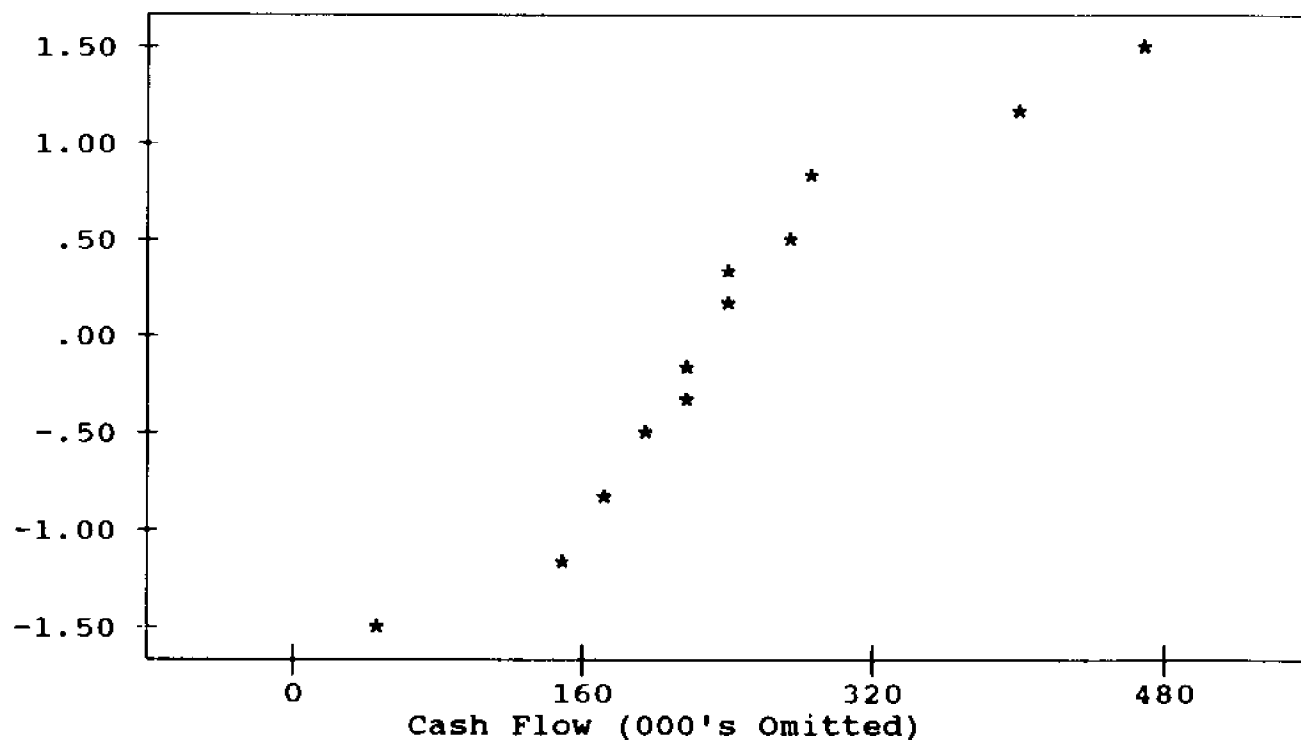
1.00 Extremes (50)
.00      1 *
2.00      1 . 58
5.00      2 * 00224
4.00      2 . 5779
2.00 Extremes (400), (470)

```

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.9414	14	.4573
K-S (Lilliefors)	.1715	14	> .2000

Case 16

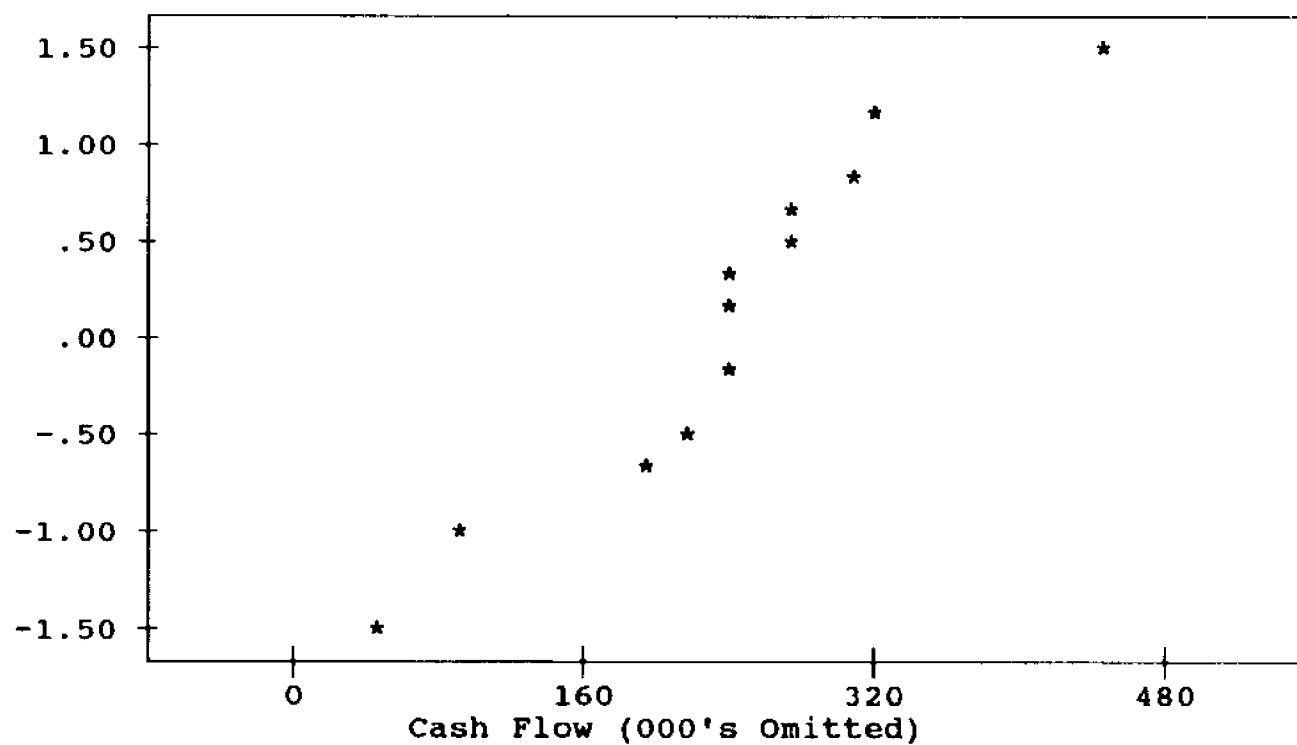
Valid cases: 14

Frequency	Stem &	Leaf
1.00	Extremes	(50)
2.00	1 *	00
.00	1 .	
5.00	2 *	02444
3.00	2 .	578
2.00	3 *	12
1.00	Extremes	(450)

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



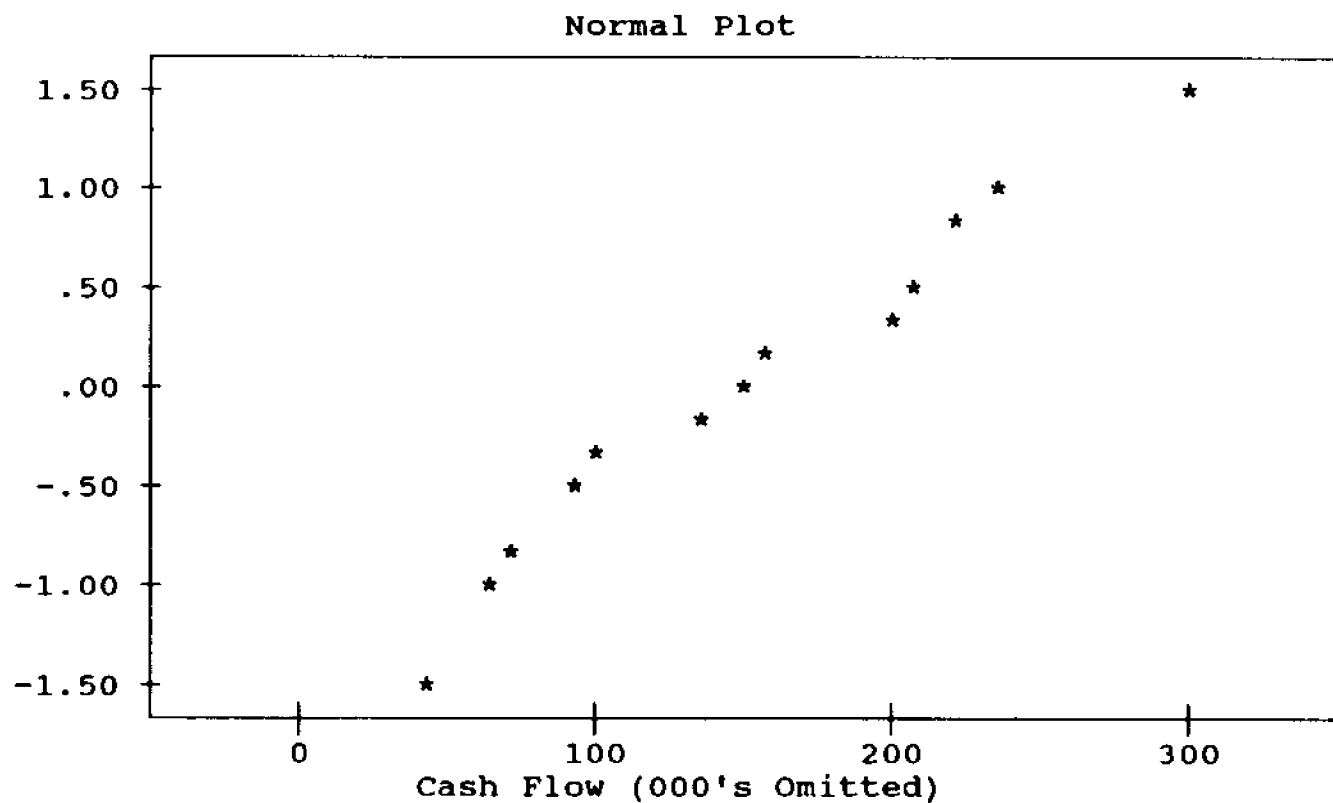
	Statistic	df	Significance
Shapiro-Wilks	.9462	14	.4937
K-S (Lilliefors)	.1210	14	> .2000

Case 17

Valid cases: 13

Frequency	Stem &	Leaf
4.00	0 .	4679
4.00	1 .	0456
4.00	2 .	0123
1.00	3 .	0

Stem width: 100
 Each leaf: 1 case(s)



	Statistic	df	Significance
Shapiro-Wilks	.9600	13	.7075
K-S (Lilliefors)	.1469	13	> .2000

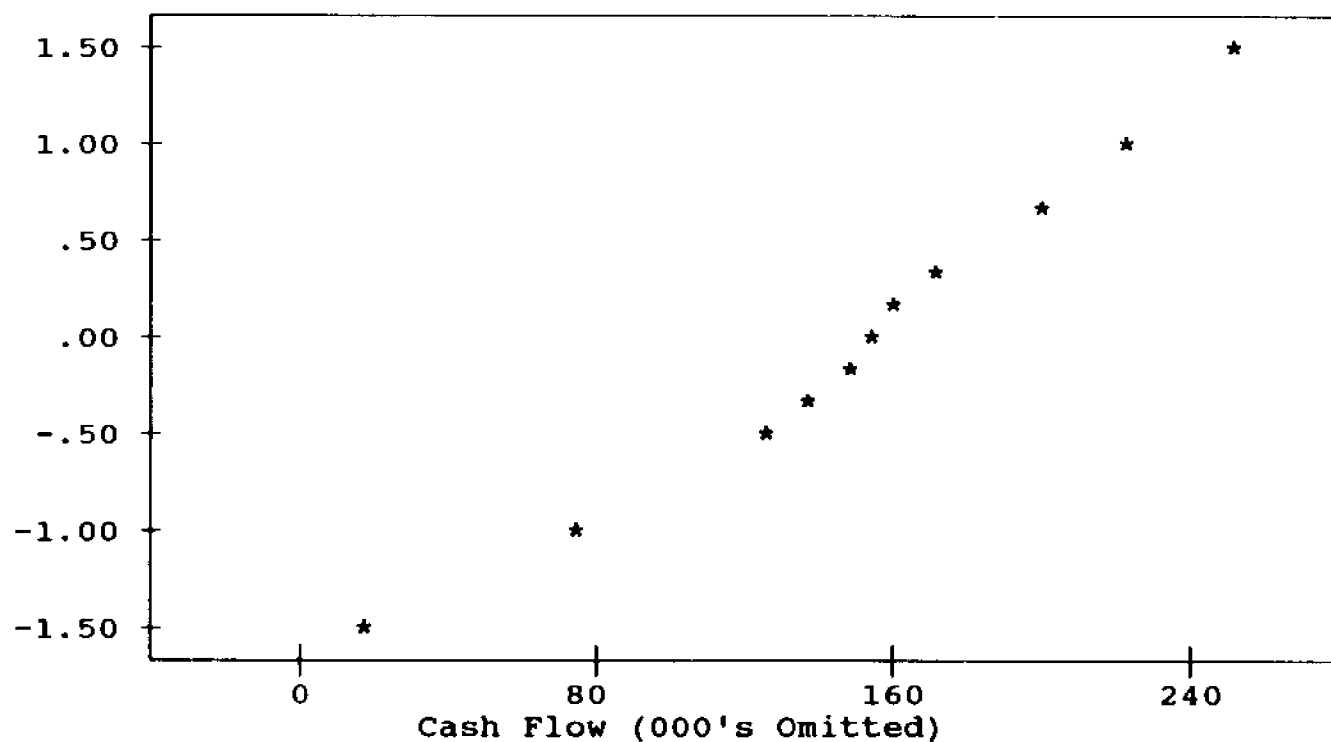
Case 18

Valid cases: 13

Frequency	Stem	&	Leaf
1.00	Extremes		(20)
2.00	0	.	77
2.00	1	*	33
4.00	1	.	5567
3.00	2	*	002
1.00	2	.	5

Stem width: 100
 Each leaf: 1 case(s)

Normal Plot



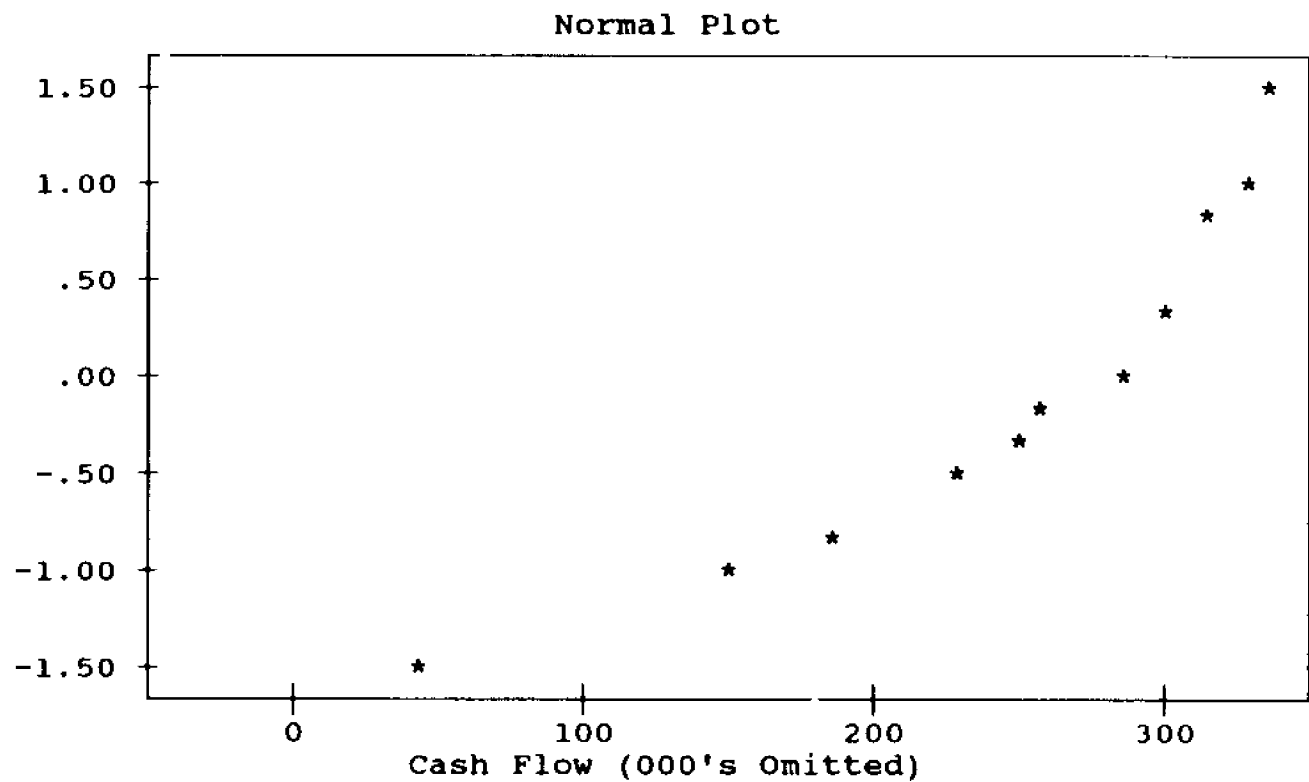
	Statistic	df	Significance
Shapiro-Wilks	.9692	13	.8337
K-S (Lilliefors)	.1075	13	> .2000

Case 19

Valid cases: 13

Frequency	Stem &	Leaf
1.00	Extremes	(45)
2.00	1 .	59
1.00	2 *	3
3.00	2 .	569
6.00	3 *	000234

Stem width: 100
 Each leaf: 1 case(s)



	Statistic	df	Significance
Shapiro-Wilks	.8523	13	.0358
K-S (Lilliefors)	.1539	13	> .2000

Case 20

Valid cases: 13

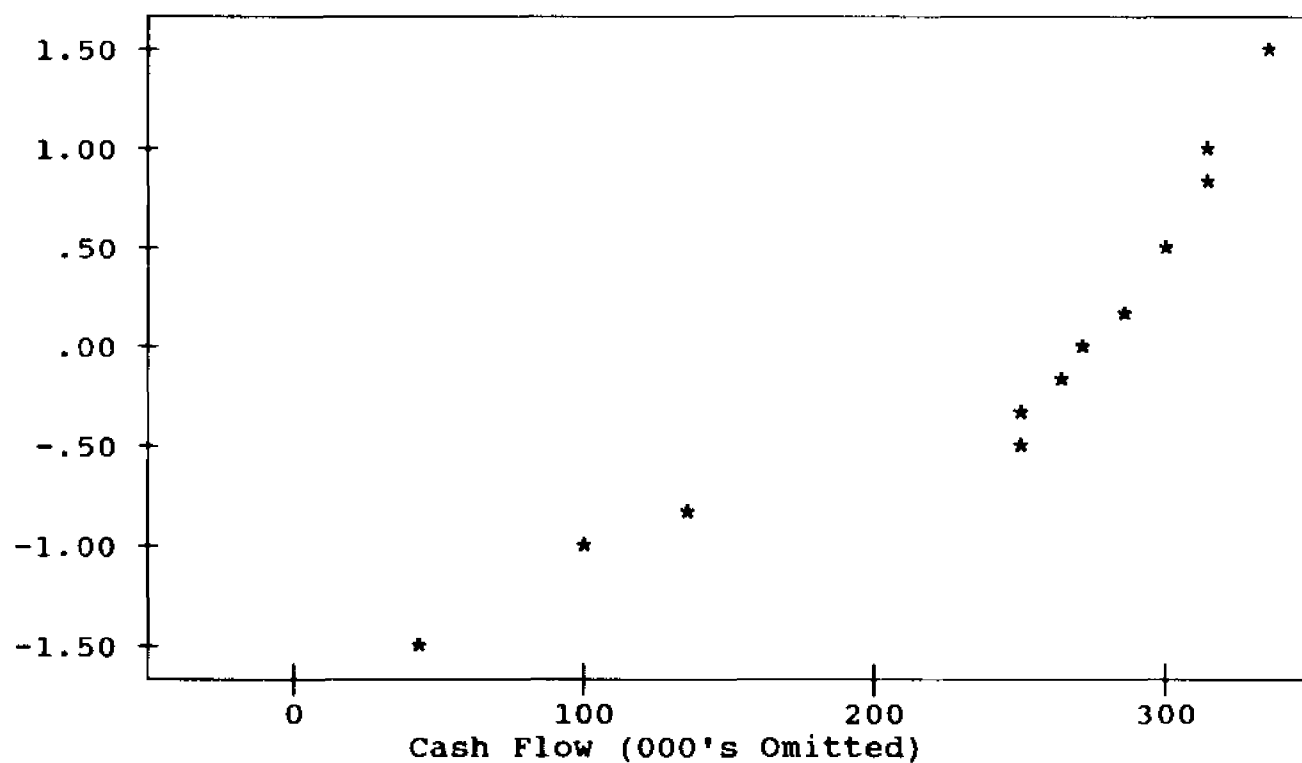
Frequency Stem & Leaf

3.00 Extremes (45), (100), (137)
 .00 2 *
 5.00 2 . 55679
 5.00 3 * 00124

Stem width: 100

Each leaf: 1 case(s)

Normal Plot



	Statistic	df	Significance
Shapiro-Wilks	.8203	13	.0127
K-S (Lilliefors)	.2110	13	.1172

Appendix D. Mann-Whitney U - Wilcoxon Rank Sum W Test

LEFT25 Left skewed, 25th percentile
by FORMAT Format

Mean Rank	Cases	
57.85	68	FORMAT = 1.00 Tabular
60.60	49	FORMAT = 2.00 Graphical

	117	Total

U	W	Z	Corrected for Ties 2-tailed P
1587.5	2969.5	-.4340	.6643

LEFT75 Left skewed, 75th percentile
by FORMAT Format

Mean Rank	Cases	
59.33	68	FORMAT = 1.00 Tabular
58.54	49	FORMAT = 2.00 Graphical

	117	Total

U	W	Z	Corrected for Ties 2-tailed P
1643.5	2868.5	-.1244	.9010

RIGHT25 Right skewed, 25th percentile
by FORMAT Format

Mean Rank	Cases	
59.92	68	FORMAT = 1.00 Tabular
57.72	49	FORMAT = 2.00 Graphical

	117	Total

U	W	Z	Corrected for Ties 2-tailed P
1603.5	2828.5	-.3456	.7297

RIGHT75 Right skewed, 75th percentile
by FORMAT Format

Mean Rank Cases

60.43	68	FORMAT = 1.00	Tabular
57.02	49	FORMAT = 2.00	Graphical

	117	Total	

U	W	Corrected for Ties	
		Z	2-tailed P
1569.0	2794.0	-.5364	.5917

Appendix E. Kruskal-Wallis 1-way ANOVA

LEFT25		Left skewed, 25th percentile				
by SCALE		Scaling and Familiarization				
	Mean Rank	Cases				
	59.26	38	SCALE =	1	Point Estimate	
	61.81	42	SCALE =	2	Education and	
	55.54	37	SCALE =	3	Probabilistic	

		117	Total			
CASES	Chi-Square	Significance	Corrected for Ties			
Significance			Chi-Square			
117	.6753	.7134	.6762		.7131	

LEFT75		Left skewed, 75th percentile				
by SCALE		Scaling and Familiarization				
	Mean Rank	Cases				
	62.25	38	SCALE =	1	Point Estimate	
	58.29	42	SCALE =	2	Education and	
	56.47	37	SCALE =	3	Probabilistic	

		117	Total			
CASES	Chi-Square	Significance	Corrected for Ties			
Significance			Chi-Square			
117	.5729	.7509	.5739		.7506	

RIGHT25		Right skewed, 25th percentile				
by SCALE		Scaling and Familiarization				
	Mean Rank	Cases				
	61.14	38	SCALE =	1	Point Estimate	
	58.17	42	SCALE =	2	Education and	
	57.74	37	SCALE =	3	Probabilistic	

		117	Total			
CASES	Chi-Square	Significance	Corrected for Ties			
Significance			Chi-Square			
117	.2281	.8922	.2285		.8920	

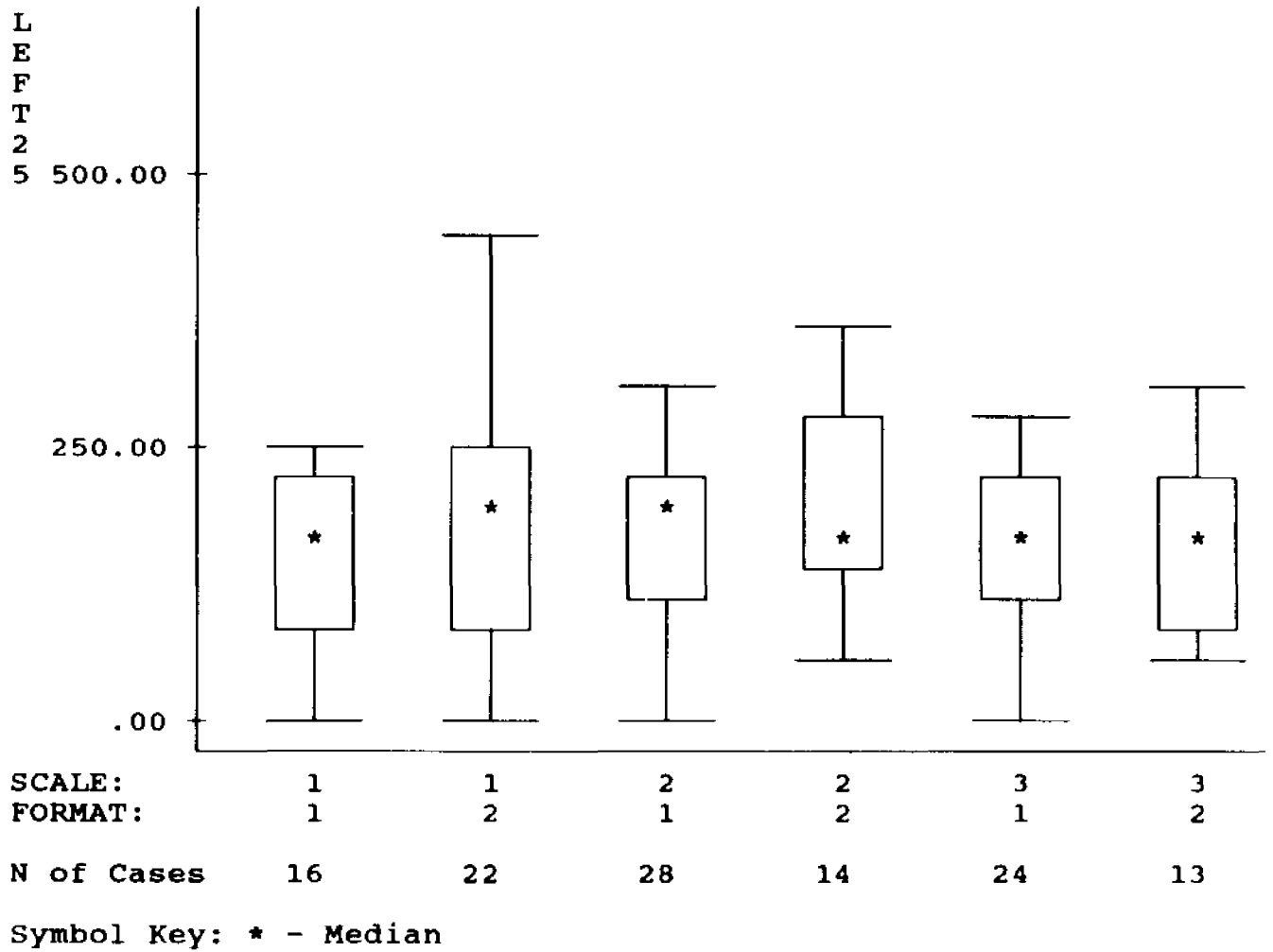
RIGHT75 Right skewed, 75th percentile
by SCALE Scaling and Familiarization

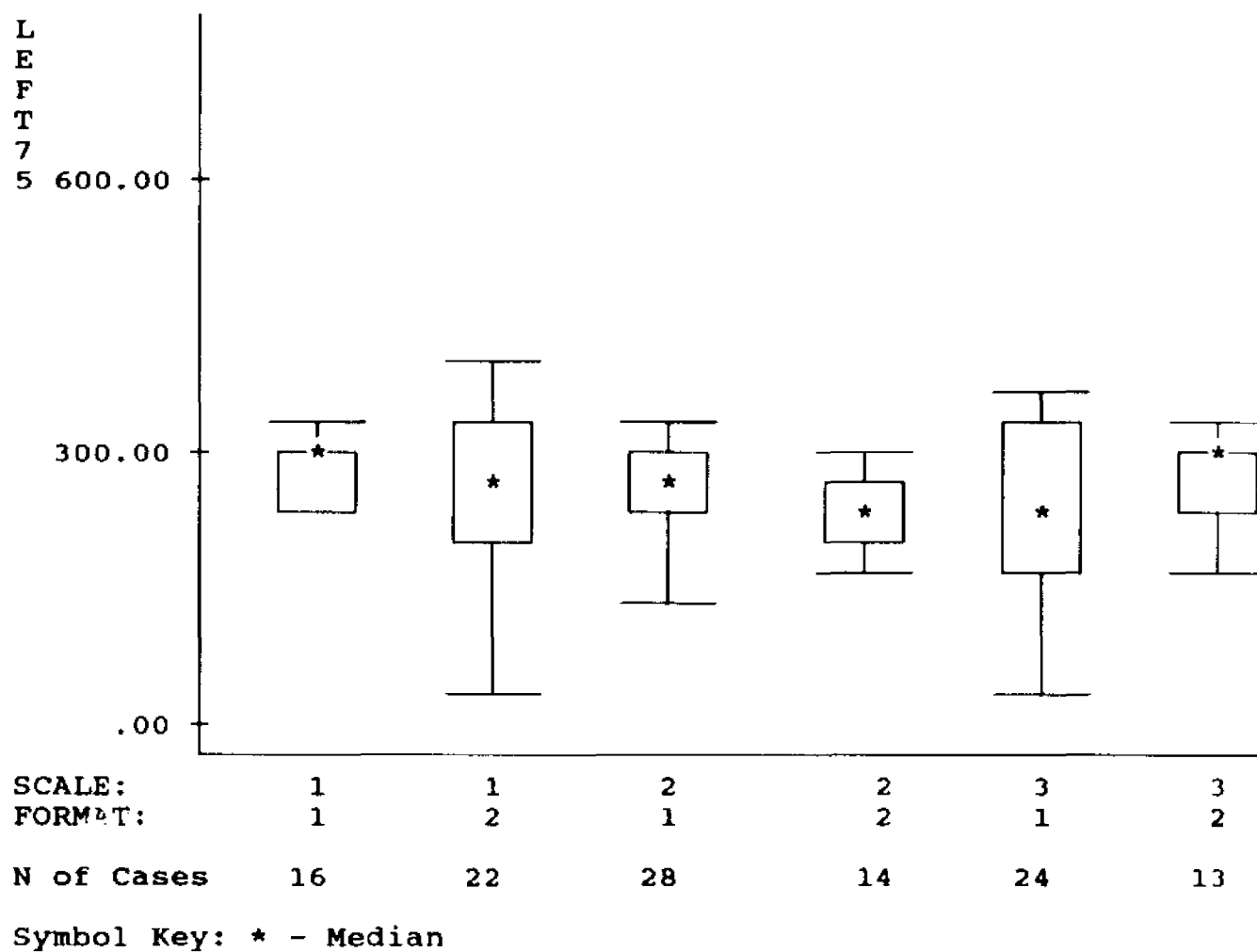
Mean Rank	Cases				
61.42	38	SCALE =	1	Point Estimate	
59.75	42	SCALE =	2	Education and	
55.66	37	SCALE =	3	Probabilistic	

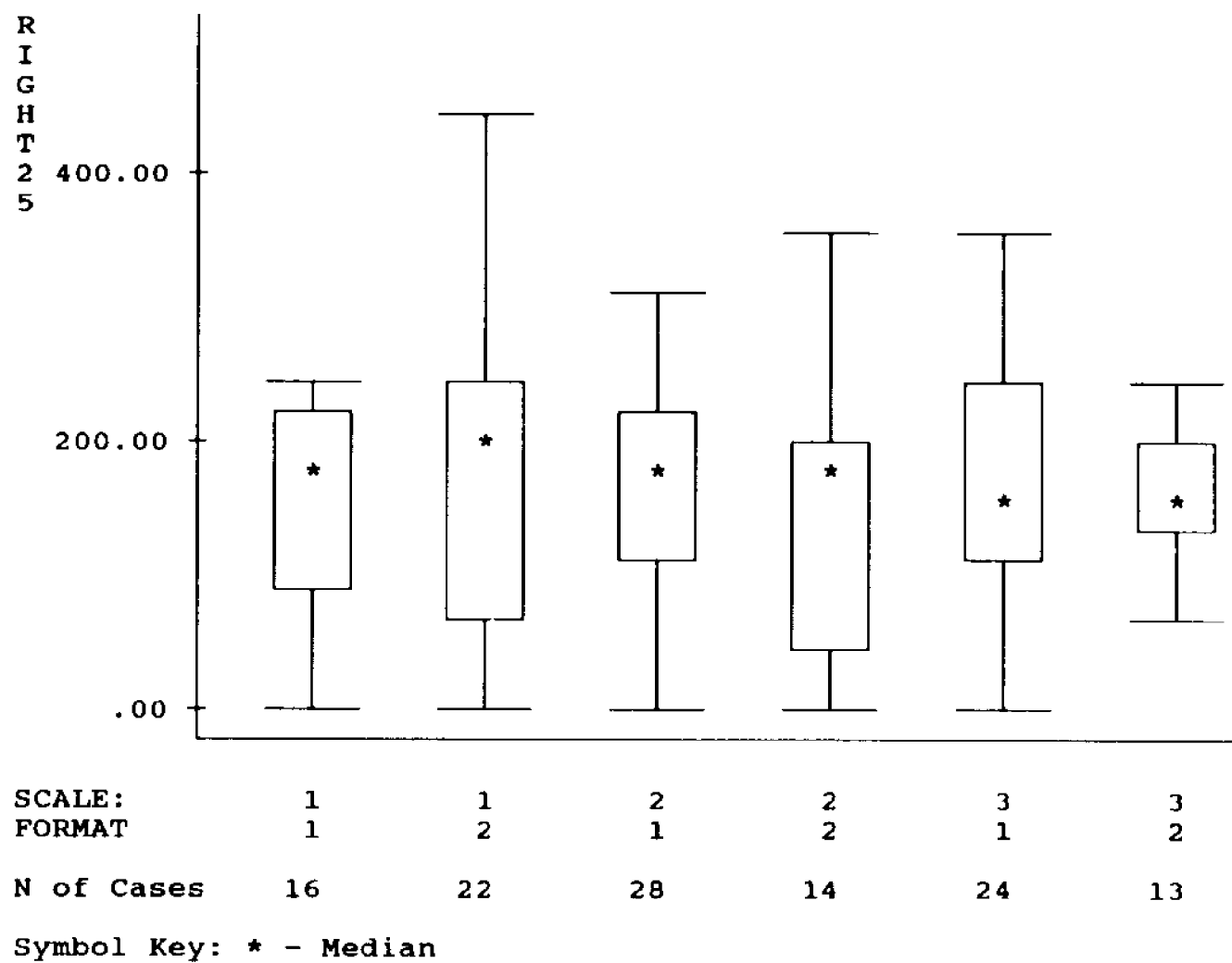
	117	Total			

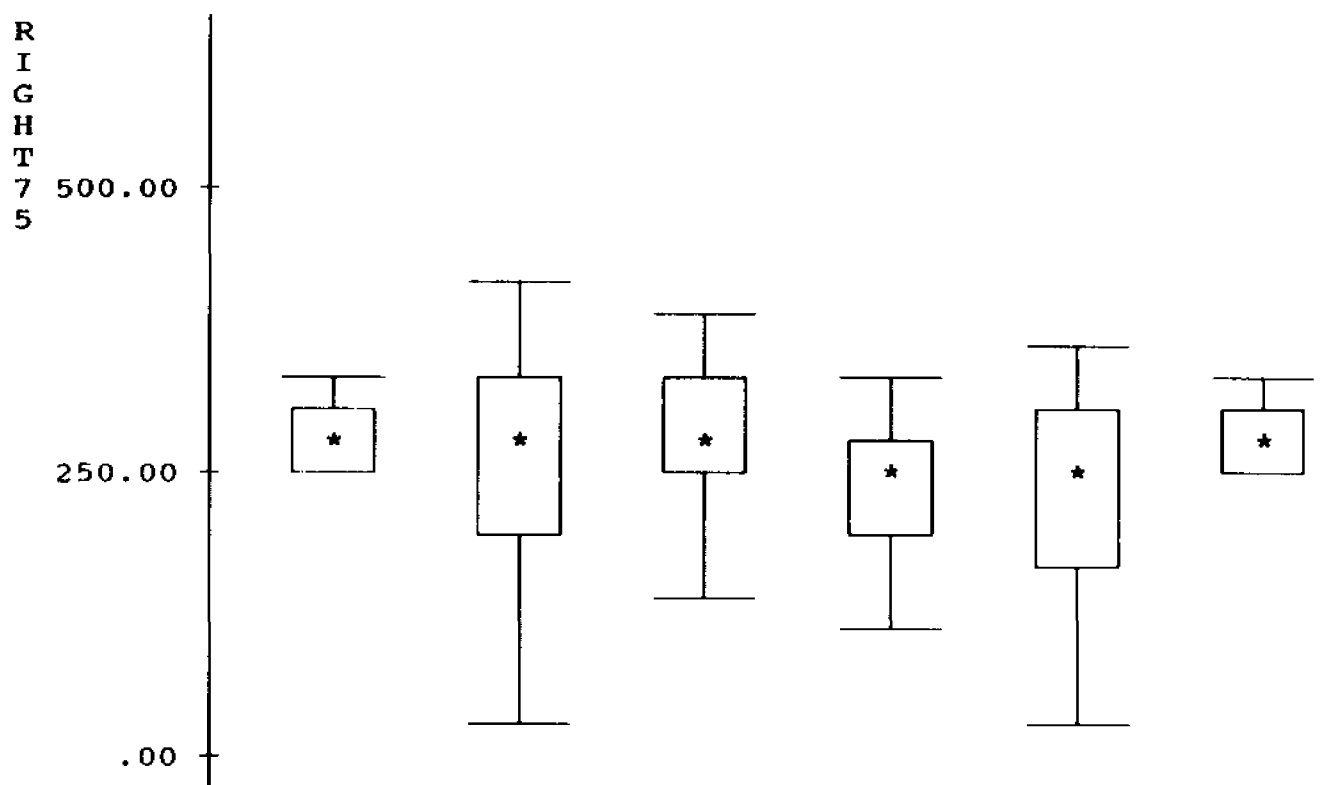
CASES	Chi-Square	Significance	Corrected for Ties Chi-Square	
117	.5724	.7511	.5736	.7507

Appendix F. Boxplots: Intrasubject Group Across Intersubject Group









SCALE:	1	1	2	2	3	3
FORMAT:	1	2	1	2	1	2
N of Cases	16	22	28	14	24	13

Symbol Key: * - Median

Appendix G. Additional Comments From Subjects

These comments were returned by the subjects after the experiment was completed.

**Additional Comments
(after experiment)**

- Subject 1: It was impossible to project future cash flows considering information presented.
- Subject 2: I thought the experiment was interesting. Certain data required to calculate net cash flow from operating activities was fairly easy to estimate (depreciation expense, provision to write-down A/R) whereas other data (components of other assets, other liabilities, P & I.) was not as clear.
- Subject 3: I found the case to be interesting. I was a little unclear at first as to the association of the graphs to the experiment, so I reworked the tutorial.
- Subject 4: Information regarding the company's business plan for the coming year would be meaningful in estimating cash flow.
- Subject 5: A company plan or budget would be a realistic expectation for use in estimating cash flows.
- Subject 6: The meaning of the A/R probability table was very unclear to me. I assumed that it indicated probability of cash inflows from collections over the next 12 mos. of A/R outstanding today.
- Subject 7: LTDebt does not agree between FN(2) and B/S on cases 1 & 2 or cases 3 & 4. Did not appear to be change in any major accounting information between cases 1 & 2 and between cases 3 & 4.
- Subject 8: With the limited amount of information, this was a total waste of time. However, I assume this was the reason of the test.
- Subject 9: I did not understand the information intended to be conveyed by the "Distribution of Accounts Receivable" screen (frequency of what? balances during the year?) and thus ignored it in determining the estimate of cash flow.
- Subject 10: Round numbers. Provide 1985 cash flow.

**Information to Assess the Amounts, Timing, and Uncertainty
of Prospective Net Cash Inflows
(after experiment)**

- Subject 1: .AR - mean & standard deviation
.collectability/write off history
.expense estimates
.sales & sale to receivable ratio
.depreciation
- Subject 2: Prior results and cash flows, five year summary
Distribution of AR was interpreted to mean collectability
Balance sheets
- Subject 3: I tried to consider the effects, if any, of the qualitative information contained in the cases. In trying to project future results bases on historical information, these cases reinforced to me the major effects that timing of accounting treatment and uncertainty of future results can have on the usefulness of current financial stmts. and related disclosures.
- Subject 4: -Five year summary (% cash flows/professional services)
-Balance sheet (A/R balance)
-A/R presentation information graphs (A/R balance)
-Financial ratios (professional services/A/R balance)
- Subject 5: I would use a significantly greater amount of current information, i.e. budgeted PPE, statistics on rate increases expected, employee workloads and productivity, behavior of G & A to revenues/volume, tax structure and the like to arrive at a pro forma income statement. Payment lags and trends on AR would be helpful, as would details of current liabilities, payables and annuals and how they relate. General items, i.e. other annual liabilities and AP seemed out of line - annual liabilities could be sub-[illegible] healthcare costs which could affect cash flow if described. Debt numbers seemed strange, to much cash on hand, should pay off debt. Also, interest expense was way high historically based on debt structure. Seasonality, if any would help as would suggested 1988 #'s, SWB increases, occupancy costs, PPE additions, etc.
- Subject 6: Would definitely have liked to have more detail of the payables, particularly the large reason for the increase. I was a lot more concerned about the cash outflows on the liability side rather than the inflows from receivables and other assets.
- Subject 7: -Previous years' statements of cash flows
-Current assets/liabilities on latest B/S
-Footnotes: upcoming obligations on debt commitments to purchased fixed assets
-3 years' income statements; earnings trends.
-MD&A: earnings prospects, A/R problems, debt repayment & restructuring, capital outlays

- Subject 8:** Knowing prior years financial data is helpful, but management's future intentions would help a great deal in predicting operations & expenditures.
- Subject 9:** How many doctors, etc. each year to determine revenue/doctor? Did decrease in market share mean less patients or decreasing share of total patients available? Revenue/patient data would have helped. Did not use RMA data to any great extent. Comparative RMA between years might have useful to identify trends. Billing trends (i.e. net collection period) would also have been somewhat useful.
- Subject 10:**
- MD&A for public companies
 - commitments footnote disclosures
 - trend data from B/S, I/S & cash flow stmt
 - other F/N disclosures
- Subject 11:** Simply not enough background info. There was no info regarding forecasted changes in rates/volume or changes in salaries & wages, etc.
- Subject 12:** I would like to see: 1) Past comparisons of actual to budget (this would give indication of how mgt can forecast), 2) Business plan, both short and long range, 3) Review of actual results from fiscal year end through just prior to issuance of audit report.
- Subject 13:** In addition to basic financial info, marketing/sales information and other info. estimating future activity is necessary to come up with a reasonable estimate of cash flow.
- Subject 14:**
- Could have used
 - .Monthly volume to better evaluate trends
 - .Volume/rate matrix
 - .More competitor data
 - .More data on HMO/aging of its receivable/trend of its % of business
 - .Rate/wage changes planned
 - Did use
 - .Historical trend (ignoring 1985 & prior due to unexplained 85-86 aberration)
 - .Expected continued A/R increase due to HMO and economy
 - .Expected level or declining A/P in future as current year % increase way out of proportion to business level
 - .Anticipated future pressure on volume.
- Subject 15:**
- Historical results of operations and cash flows.
 - Budgeted results and cash flows
 - Detail of management plans and assumptions for the coming period.
 - Additional background data.
- Subject 16:** Change in # of customers & distribution. Trend line of cash flow of competition in area. Capital expansion master plan. Bank relationship.

Paul M. Goldwater

VITA

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July 21, 1989

Academic Data

University of Auckland, Auckland, New Zealand
Bachelor of Commerce - Major Accounting and Economics, 1972.

University of Otago, Dunedin, New Zealand
Post Graduate Diploma in Commerce - Major Accounting and Systems,
1975.

University of West Florida, Pensacola, Florida
Bachelor of Science - Major Accounting, 1981.

Professional Qualifications

A.C.A. - Associated Chartered Accountant, New Zealand
C.M.A. - Cost and Management Accountant, New Zealand

Teaching And Research Preferences

Accounting information systems
Managerial accounting
Financial accounting

Professional Experience

1. Fall 1984 to present
Doctoral candidate, Louisiana State University
Major: accounting and systems
Minor: statistics and operations research
2. March 1981 to August 1984
Consultant - two large consulting assignments
design of a 700 bed hospital information system, patient and
financial systems, preparation of a request for proposal and
evaluation of vendors' proposals.

design of an integrated computerized marketing, production and accounting system for a continuing medical education company.

3. January 1980 to March 1981
Assistant Professor of Accounting
Responsible for teaching cost accounting, systems and financial accounting.
4. February 1977 to January 1980
Arthur Young & Company, Oklahoma City
Senior Consultant in Management Services
Feasibilities studies, analysis and design of small and large accounting information systems, EDP auditing.
5. January 1974 to January 1977
Lecturer, University of Otago and University of Auckland, New Zealand
Responsible for teaching financial accounting and management accounting.
6. July 1972 to December 1973
Assistant Controller, General Foods N.Z. Ltd., Dunedin, New Zealand

Teaching Experience

Courses taught:

Financial Accounting
Intermediate Accounting I
Cost Accounting I
Cost Accounting II
Cost Accounting and Case Studies (graduate)
Accounting Information Systems

Professional Organization Memberships

New Zealand Society of Accountants
American Accounting Association
Operations Research Society of America
National Decision Sciences

Professional Organization Offices and Activities

Vice President of Manuscript Committee, Pensacola Chapter of NAA.
Vice President of Education and Professional Development, Pensacola Chapter of NAA.

Completed Empirical Research

"Tabular Versus Graphical Information: An Experiment", (with Robert Harper and Bart Hartman).

"Computerized Exams vs Paper Exams", (with Roger Guyette).

Publications

"An Inventory System Using Monte Carlo Simulation, Symphony And A Microcomputer", Business Planning, Spring 1987.

Presentations

"Evaluating a Tax Shelter", Proceedings of the Southwest AIDS Conference, March 1985, (with Roger Guyette).

"Computers in Health Care", Biannual New Zealand Medical Conference, May 1985.

"A Decision Support System Using Monte Carlo Simulation, Symphony, And A Microcomputer", Proceedings of the National Decision Science Conference, November 1986.

"An Inventory System Using Monte Carlo Simulation, Symphony, and a Microcomputer", American Accounting Association, Southwestern Region (with Robert M. Harper)

"Tabular Versus Graphical Information: An Experiment", American Accounting Association, Southeastern Region (with Robert M. Harper and Bart P. Hartman)

Invited Professional Presentations

"Integrated Software, Microcomputers And Monte Carlo Simulation: A Working Example", ORSA/TIMS Annual Conference, March 1987.

"Computerizing A Large Hospital System", Computer Science Research Forum, Louisiana State University, February 1985.

Honors

Beta Alpha Psi (National Accounting Honorary)
Phi Kappa Phi

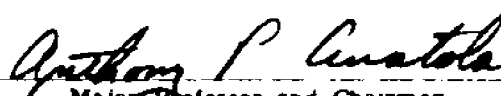
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Paul Michael Goldwater

Major Field: Accounting

Title of Dissertation: An Experiment To Study the Effects Of Changing
Format and Scaling Characteristics of Financial
Statement Data

Approved:



Major Professor and Chairman
Anthony P. Curatola



Dean of the Graduate School

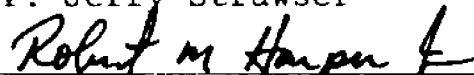
EXAMINING COMMITTEE:



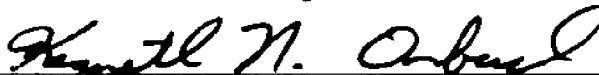
Dr. Dan Rinks



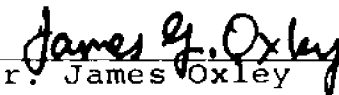
Dr. Jerry Strawser



Dr. Robert Harper



Dr. Kenneth Orbach



Dr. James Oxley

Date of Examination:

Wednesday, July 19, 1989